5-3810-288-12

TM 5-3810-288-12

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR AND ORGANIZATIONAL
MAINTENANCE MANUAL
FOR

CRANE, SHOVEL, TRUCK MOUNTED
20 TON, 3/4 CU. YD., G.E.D., 6 x 6
(HARNISCHFEGER MODEL M320T)
FSN 3810-861-8088

This copy is a reprint which includes current pages from Change 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1970

TM 5-3810-288-12 CRANE, SHOVEL, TRUCK MOUNTED, 20 TON—1970

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READEX FICHE best copy available

SAFETY PRECAUTIONS

BEFORE OPERATION

Make certain that the crane and carrier have been deprocessed completely before servicing. Make certain that preservatives have been removed from crankcase, fuel tanks, gearcases, machined surfaces, and the like.

Where there is no interference with machine operation, mount the tagline winder with the cable drum on the side away from the operator, to reduce interference with the operator's vision.

If there is tension on the tagline, do not release the tagline suddenly; to do so may cause damage to the tagline winder.

Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful injury may result.

Turn radiator cap slowly and allow pressure to escape before removing it.

Lower the attachment to the ground before attempting to adjust the boom hoist brake. Serious damage to the equipment or injury to personnel may otherwise result.

Disconnect battery cables before working on electrical components.

When refueling the truck crane, provide a metal to metal contact between the filler nozzle and the gasoline tank. This will prevent sparks which might ignite fuel, and will thus prevent an unsafe condition which might destroy the machine or injure personnel.

While in the park abort condition, the carrier will have no brakes. Always block the wheels so as to prevent truck crane motion before placing the machine in the park abort condition. Do not remove blocking until the carrier is returned to normal brake system operation.

Do not shift the transfer case while the carrier is in motion.

AFTER OPERATION

The boom hoist pawl must be engaged at all times, except when lowering the boom.

Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful injury may result.

Turn radiator cap slowly and allow pressure to escape before removing it.

The swing brake is not used to stop the revolving frame from swinging while the machine is in operation. It is used solely to prevent the revolving frame from turning while the machine is not in use, such as when it is being moved from place to place.

When refueling the Model M320T Truck Crane, always provide a metal to metal contact between the filler nozzle and the gasoline tank. This will prevent sparks which might ignite fuel, and will thus prevent an unsafe condition which might destroy the machine or injure personnel.

Always inflate the tire from the side opposite the ring. If the ring is improperly installed, air pressure may cause it to fly off the wheel, and serious injury to personnel may result.

Inflate tires from the side opposite the ring. If the ring is improperly installed, air pressure may cause it to fly off the wheel, and serious injury to personnel may result.

DURING OPERATION

Proceed slowly and carefully when removing or installing the counterweight, since severe damage can be caused by improper handling.

Do not transport the truck crane with the piledriver front-end attachment installed.

Use care when swinging the revolving frame without a boom, since it will tend to be unbalanced toward the counterweight end.

Do not reply on the ratchet brake locks on the front or rear drum brake pedals to suspend a load. The operator must remain in a position of readiness, with feet on pedals, at all times that a load is suspended.

The boom hoist pawl must be engaged at all times, except when lowering the boom. Do not attempt to engage the boom hoist pawl while lowering the boom.

Do not crank engine for more than 30 seconds continuously without allowing a 2-minute cooling period. If engine does not start after a few tries, stop cranking. Determine the cause and correct, or report to organizational maintenance.

Do not attempt to raise the boom by means of the boom hoist lines if the boom tip is below the ground level which supports the carrier. The angle of pull on the boom will be such that the boom may collapse before it can be pulled into the operating position.

Check the engine frequently for overheating in high altitude operation.

TM 5-3810-288-12
*C 3

CHANGE No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC *15 December 1980*

Operator and Organizational Maintenance Manual For CRANE, SHOVEL, TRUCK MOUNTED 20 TON, 3/4 CU. YD., G.E.D., 6 X 6 (HARNISCHFEGER MODEL M320T) NSN 3810-00-861-8088

TM 5-3810-288-12, 26 February 1970, is changed as follows:

Page 1-1.

Paragraph 1-1*a* is superseded as follows:

a. This manual is for your use in operating and maintaining the Harnischfeger model M320T truck mounted crane.

Paragraph 1-1*c* is deleted.

Paragraph 1-2*b* is superseded as follows:

b. Reporting Errors and Recommending Improvements. You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Tank-Automotive Materiel Readiness Command, ATTN: DRSTA-MBP, Warren, MI 48090. A reply will be furnished to you.

Page 1-7, figure 1-9. Delete callout "20" and "leader" which points to cab door of carrier.

Page 1-8, figure 1-9.

Change "REF 17" to "REF 19".

Change "REF 19" to "REF 17".

Page 1-10, figure 1-9.

WITHOUT OUTRIGGERS instruction plate, line 1, 30 FT BOOM column.

Under OVER SIDE column. Change "28,900" to "27,300".

Under OVER REAR column. Change "27,300" to "28,900".

Line 10 of paragraph at bottom of page. Change "34 CUBIC YARDS" to "3/4 CUBIC YARD".

Page 1-11.

Paragraph 1-4*b*(2).

Line 10. Change "Intake valve tappet clearance ..... 0.011 to 0.013 inch" to "Intake valve tappet clearance (engine hot) ..... 0.014 to 0.016 inch".

Line 11. Change "Exhaust valve tappet clearance ..... 0.024 to 0.026 inch" to "Exhaust valve tappet clearance (engine hot) ..... 0.034 to 0.036 inch".

Paragraph 1-4*b*(3).

Line 6. Change "Intake valve tappet clearance ..... 0.012 to 0.014 inch" to "Intake valve tappet clearance (engine hot) ..... 0.012 to 0.014 inch".

Line 7. Change "Exhaust valve tappet clearance ..... 0.023 to 0.025 inch" to "Exhaust valve tappet clearance (engine hot) ..... 0.023 to 0.025 inch".

Page 1-17, figure 1-14, resistance value of small wire leading from the MAGNETIC SWITCH (located in left-center of diagram) to the starter relay. Change "20 ohms" to "2 ohms".

Page 2-2. Following paragraph 2-1*c*(15) add subparagraph (16). (16) Refer to table 2-1 for maintenance and operating supplies.

Add table 2-1 as follows:

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*This change supersedes C 1, 7 July 1972 and C 2, 20 September 1973.

Table 2-1. Maintenance and Operating Supplies

(1) Component application	(2) National stock number	(3) Description	(4) Quantity required for initial operation	(5) Quantity required for 8 hours operation	(6) Notes
Air Cleaner		OIL, LUBRICATING			(1) Includes quantity of oil to fill engine oil system as follows: Crane Engine: 16 qt Carrier Engine: 28 qt Carrier Air Cleaner: 4 qt Crane Air Cleaner: 2 qt (2) See C9100-IL for additional data and requisitioning procedure. (3) See current LO for grade application and replenishment intervals. (4) Fuel tank capacities: Crane: 50 gal Carrier: 75 gal (5) Average fuel consumption gal per hour (GPH) of continuous operation: Crane: 7.5 GPH Carrier: 13.7 GPH (6) Transmission capacities: Crane: 4-1/2 qt Carrier: 8 qt Drop box: 4 qt (7) Front Differential: 11 qt Dual Differential: 11 qt
	9150-00-265-9435 (2)	OE 30	(1)	(3)	
	9150-00-186-6668 (2)	OE 10	(1)	(3)	
	9150-00-402-2372 (2)	OEA	(1)	(3)	
Crankcase		OIL, LUBRICATING; 5 gal can as follows:			
	9150-00-265-9435 (2)	OE 30	(1)	(3)	
	9150-00-265-9428 (2)	OE 10	(1)	(3)	
	9150-00-402-2372 (2)	OEA	(1)	(3)	
Differentials		LUBRICATING OIL, GEAR; 5 gal drum as follows:			
	9150-00-577-5847 (2)	GO 140	(7)	(3)	
	9150-00-577-5844 (2)	GO 90	(7)	(3)	
Exposed Gear		LUBRICATING OIL, EXPOSED GEAR; 35 lb pail as follows:			
	9150-00-246-3276 (2)	CW11-B	5 lb	(3)	
Gear and Chaincase		LUBRICATING OIL, GEAR; 5 gal can as follows:			
	9150-00-577-5847 (2)	GO 140	72 qt	(3)	
	9150-00-577-5844 (2)	GO 90	72 qt	(3)	
Grease Points		GREASE, AUTOMOTIVE AND ARTILLERY; 35 lb pail as follows:			
	9150-00-190-0907 (2)	GAA			
Hydraulic Control Reservoir		BRAKE FLUID: Automotive; 1 gal can as follows:			
	9150-00-252-6375 (2)	HBA	3 qt	(3)	
Hydraulic Steering System		HYDRAULIC FLUID: 1 gal can as follows:			
	9150-00-223-4134 (2)	OHA	7 qt	(3)	
Power Transfer		LUBRICATING OIL, GEAR; 5 gal drum as follows:			
	9150-00-577-5847 (2)	GO 140	6-1/2 qt	(3)	
	9150-00-577-5844 (2)	GO 90	6-1/2 qt	(3)	
Radiator		ANTIFREEZE: 55 gal drum as follows:			
	6850-00-181-7933	Ethylene Glycol			
		Crane Engine	24 qt		
		Carrier Engine	36 qt		
	6850-00-174-1806	ANTIFREEZE: Compound Arctic			
		Crane Engine	38 qt		

Table 2-1. Maintenance and Operating Supplies - Continued

(1) Component application	(2) National stock number	(3) Description	(4) Quantity required for initial operation	(5) Quantity required for 8 hours operation	(6) Notes
		Carrier Engine	60 qt		
Tank, Fuel	9130-00-160-1818 (2)	FUEL, GASOLINE; Bulk as follows:			
		Automotive combat 91A	(4)	(5)	
Transmission		LUBRICATING OIL, GEAR; 5 gal drum as follows:			
	9150-00-577-5847 (2)	GO 140	(6)	(3)	
	9150-00-577-5844 (2)	GO 90	(6)	(3)	
	9150-00-257-5440 (2)	GOS	(6)	(3)	

Page 2-3.

Figure 2-3 is superseded as follows:

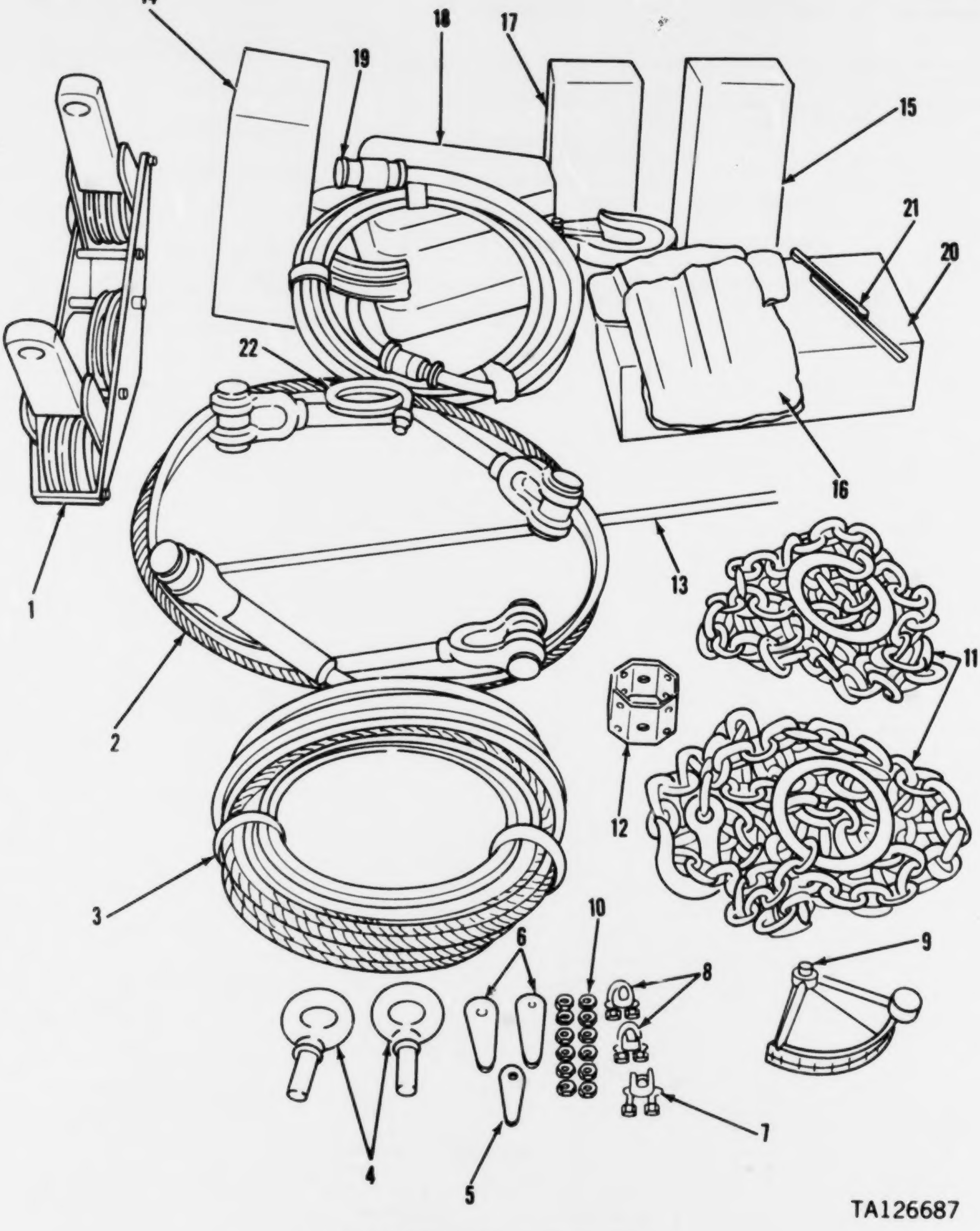
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Figure 2-3. Separately packaged components.

Legend for figure 2-3, item 22, is added as follows: "22. Plug assy, clearance lights".

Page 2-7, following 2-5*e*(4) add the following:

CAUTION

Be sure that cable does not drag on the inside rear of the boom point cable guards. Position cable outside the guards when reeving a three or more part line.

Page 2-13.

Paragraph 2-8*b*(4), line 4. Change "left" to "right".

Paragraph 2-8*b*(5), line 4. Change "right" to "left".

Page 2-16, figure 2-2. Change "LEFT BOOM POINT SHEAVE" to "RIGHT BOOM POINT SHEAVE" and change "RIGHT BOOM POINT SHEAVE" to "LEFT BOOM POINT SHEAVE".

Page 2-42.

POSITIONING THE PILEDRIVER, lines 1, 2, and 3. Change "REAR" to "FRONT".

SETTING THE PILE.

Line 1. Change "REAR" to "FRONT".

Lines 2 and 4. Change "FRONT" to "REAR".

Page 2-43.

LIFTING THE HAMMER, lines 1 and 2. Change "REAR" to "FRONT".

DROPPING THE HAMMER. Change "REAR" to "FRONT".

DRIVING THE PILE, lines 2 and 7. Change "REAR" to "FRONT".

Page 2-49, paragraph 2-28*c*. The second sentence is superseded as follows: "Do not lubricate the roller path; lubricant on the roller path will collect sand and cause rollers to wear excessively."

Page 3-1. Section III is superseded as follows:

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (CRANE)

3-4. General

Preventive maintenance is detecting/correcting problems before they happen, or fixing little problems before they become big problems. Table 3-1 contains a list of preventive maintenance checks and services to be performed by operator/crew. Table 3-1.1 contains preventive maintenance checks and services to be performed by organizational maintenance personnel. Attention to these checks and services will increase the useful life of the equipment, but every possible problem cannot be covered in the PMCS. Be alert for anything that might cause a problem.

3-5. Maintenance Forms and Records

Every mission begins and ends with the paperwork. There isn't much of it, but you have to keep it up. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your equipment. They are reports to maintenance people and to your commander. And they are a checklist for you when you want to know what is wrong with the equipment after its last use, and whether those faults have been fixed. For the information you need on forms and records, see TM 38-750.

3-5.1. Preventive Maintenance Checks and Services

a. Operator/crew shall perform the preventive maintenance checks and services shown in table 3-1.

(1) Do your (B) PREVENTIVE MAINTENANCE just before you operate the equipment. Pay attention to the CAUTIONS and WARNINGS.

(2) Do your (D) PREVENTIVE MAINTENANCE during operation. During operation means to monitor the crane and its related components while it is actually being operated.

(3) Do your (A) PREVENTIVE MAINTENANCE right after operating the equipment. Pay attention to the CAUTIONS and WARNINGS.

(4) Do your (W) PREVENTIVE MAINTENANCE weekly.

(5) Do your (M) PREVENTIVE MAINTENANCE once a month.

b. Organizational maintenance personnel shall perform the preventive maintenance checks and services shown in table 3-1.1.

(1) Do the (Q) checks and services once each three months.

(2) Do the (S) checks and services twice each year, or each six months.

(3) Do the (A) checks and services once each year.

(4) Do the (B) checks and services once each two years.

(5) Do the (H) checks and services at the hour interval listed.

(6) Do the (MI) checks and services when the mileage of the vehicle reaches the amount listed.

WARNING

Drycleaning solvent, SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138°.

c. Make cleanup a part of your preventive maintenance. Dirt, grease, oil, and debris may cover up a serious problem. Wipe off excess grease and spilled oil. Use drycleaning solvent (SD-2) to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

d. Watch for and correct anything that might cause a problem with the equipment. Some things you should watch for are:

(1) Bolts, nuts, and screws that are loose, missing, bent, or broken.

(2) Welds that are bad or broken.

(3) Electric wires and connectors that are bare, broken, or loose.

(4) Hoses and fluid lines that leak, or show signs of damage or wear.

e. You should know how fluid leaks affect the status of your equipment. Learn and be familiar with the following definitions of the types/classes of leakage. Remember — when in doubt, notify your supervisor!

Leakage definitions for PMCS are:

Class I	Seepage of fluid (indicated by wetness or discoloration not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.
Class III	Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course consideration must be given to the fluid capacity in the item/system being checked/inspected. when in doubt, notify your supervisor.

Class III leaks should be corrected before releasing equipment for operation.

f. If the equipment doesn't work properly and you can't see what is wrong, refer to table 4-4 for troubleshooting instructions.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services (CRANE)

B-Before D-During A-After W-Weekly M-Monthly

Item no.	Interval B	D	A	W	M	ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/available if:
						NOTE PERFORM WEEKLY AS WELL AS BEFORE PCMS IF: *a.* You are the assigned operator, but have not operated the crane since the last weekly. *b.* You are operating the crane for the first time.	
1						MAKE THE FOLLOWING WALK AROUND CHECKS: (Exterior of vehicle)	
	●					*a.* Check for evidence of leakage (oil, fuel, hydraulic fluid or coolant) on or under the crane.	Class III leakage is evident (no fuel leakage allowed).
	●					*b.* Visually check for loose, missing or damaged parts.	
2	●					RADIATOR: Check coolant level. Fill to the overflow.	Class III leakage is evident.
3	●					BELTS Inspect fan and alternator belts for frayed or deteriorated condition.	Belt missing or broken
4				●		BATTERIES Check level of electrolyte. If low, fill with clean water (distilled if possible) to the split ring. In freezing weather, run engine at least 15 minutes after adding water. (TM 9-6140-200-14)	
5	●					ENGINE Check oil level, add oil to full mark on dipstick.	
6						INSTRUMENTS Check for normal operating readings for the instruments as follows:	Pressure/temperature gages not within ranges specified.
		●				*a.* TEMPERATURE 160 to 200°F	
		●				*b.* ENGINE OIL PRESSURE 35 to 45 psi	
		●				*c.* VOLTMETER 12.8 to 13.8v	

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services (CRANE) – Continued

B-Before D-During A-After W-Weekly M-Monthly

Item no.	Interval					ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/available if:
	B	D	A	W	M		
		●				*d.* TACHOMETER (full load) 1800 RPM	
7		●				LIGHTS Check for proper operation.	
8		●				CONTROL LEVERS AND PEDALS Check for proper operation.	
9	●					LOAD ROLLERS Inspect for breaks, cracks and wear.	Rollers are broken or cracked.
10	●					HOISTING CABLES Inspect for stretch, wear and damage.	Six broken wires in one rope lay or three wires in one strand of one rope lay or four percent of total number of wires in rope in length of one rope lay.
11	●					BOOM ASSEMBLY Inspect for cracks, bends and damage. Check for damaged or missing boom stop safety bracket. Check boom point for cracks and damaged sheaves.	Bent or broken.
12	●					HOOK BLOCK Inspect for cracks and damaged sheaves.	Cracked or deformed.
13					●	OILDEX FILTER Clean glass cup.	
14				●		HYDRAULIC FLUID RESERVOIR Add fluid to approximately one inch below top of reservoir.	
15						RAIN SHUTTERS	
	●					*a.* Open before starting engine.	
			●			*b.* Close after stopping engine.	
16	●					AIR CLEANER Add oil to full mark.	

Table 3-1.1. Organizational Preventive Maintenance Checks and Services (CRANE) – Continued

Legend

Q-Quarterly	A-Annually	H-Hours
S-Semiannually	B-Biennially	MI-Miles

Item no.	Interval						ITEM TO BE INSPECTED Procedure
	Q	S	A	B	H	MI	
							NOTE PERFORM OPERATOR/CREW PMCS PRIOR TO OR IN CONJUNCTION WITH ORGANIZATIONAL PMCS.
1							COOLING SYSTEM
	●						*a.* Inspect hoses and lines for evidence of leaks, abrasions, kinks, restrictions and loose mounting.
	●						*b.* Use hydrometer to measure coolant system freezing point. Add antifreeze as required to protect coolant system to lowest expected ambient temperature (TB 750-651).
2	●						CLUTCHES AND BRAKES Adjust or replace linings as necessary.
3	●						HOOK ROLLERS Check for cracked or broken rollers. Check roller path for contamination.
4	●						FUEL SYSTEM Check for leaks. Clean sediment bowl.
5					50		AIR CLEANER Disassemble, clean, change oil, and reassemble.
6							ENGINE
					100		*a.* Change oil and filter.

Table 3-1.1. Organizational Preventive Maintenance Checks and Services (CRANE) – Continued

Legend

Q-Quarterly
S-Semiannually
A-Annually
B-Biennially
H-Hours
MI-Miles

Item no.	Interval						ITEM TO BE INSPECTED Procedure
	Q	S	A	B	H	MI	
	●						*b.* Clean oildex filter.
	●						*c.* Adjust or replace belts as necessary.
7	●						LIGHTS Check for proper operation and/or damage and repair as necessary.
8	●						HOIST CHAIN AND REVERSING CHAIN Check for wear and proper adjustment.

Page 3-9. Paragraph 3-14*a*, second sentence, is superseded as follows: "If necessary, rinse the cap in clean diesel fuel, kerosene, or an approved solvent, allowing to drain dry before replacing".

Page 3-49, figure 3-43.

Change "INTAKE 0.011-0.013" to "INTAKE (HOT ENGINE) 0.012 to 0.014".

Change "EXHAUST 0.024-0.026" to "EXHAUST (HOT ENGINE) 0.023 to 0.025".

Page 3-54.

Paragraph 3-49*d*(3) *(b)* is superseded as follows: "Check the continuity of the coil primary (fig. 3-54) by ensuring the ignition switch is "OFF", then connect an ohmmeter across the primary terminals and position the ohmmeter selector switch to "Low Scale". The ohmmeter reading should be very low".

Paragraph 3-49*d*(3) *(c)* is superseded as follows: "Check the continuity of the coil secondary (fig. 3-54) by ensuring the ignition switch is "OFF", then connect an ohmmeter across one primary terminal and the secondary terminal (Tower). Set the ohmmeter selector switch to "middle" or "high" scale. Coil is defective if reading is infinite".

Paragraph 3-49*d*(3) *(d)* is deleted.

Page 3-93, paragraph 3-58*d*(2). Following the last sentence, add the following: "Inspect frame and pendant attachment arms for broken welds, damage, or deformation. Replace or repair all damaged framing members".

Page 6-4, figure 6-1. Delete item "45".

Page 6-5. Delete item "45" from legend.

Page 7-1. Section III is superseded as follows:

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (CARRIER)

7-4. General

Preventive maintenance is detecting/correcting problems before they happen, or fixing little problems before they become big problems. Table 7-1 contains a list of preventive maintenance checks and services to be performed by operator/crew. Table 7-1.1 contains preventive maintenance checks and services to be performed by organizational maintenance personnel. Attention to these checks and services will increase the useful life of the equipment, but every possible problem cannot be covered in the PMCS. Be alert for anything that might cause a problem.

7-5. Maintenance Forms and Records

Every mission begins and ends with the paperwork. There isn't much of it, but you have to keep it up. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your equipment. They are reports to maintenance people and to your commander. And they are a checklist for you when you want to know what is wrong with the equipment after its last use, and whether those faults have been fixed. For the information you need on forms and records, see TM 38-750.

7-5.1. Preventive Maintenance Checks and Services

a. Operator/crew shall perform the preventive maintenance checks and services shown in table 7-1.

(1) Do your (B) PREVENTIVE MAINTENANCE just before you operate the equipment. Pay attention to the CAUTIONS and WARNINGS.

(2) Do your (D) PREVENTIVE MAINTENANCE during operation. During operation means to monitor the carrier and its related components while it is actually being operated.

(3) Do your (A) PREVENTIVE MAINTENANCE right after operating the equipment. Pay attention to the CAUTIONS and WARNINGS.

(4) Do your (W) PREVENTIVE MAINTENANCE weekly.

(5) Do your (M) PREVENTIVE MAINTENANCE once a month.

b. Organizational maintenance personnel shall perform the preventive maintenance checks and services shown in table 7-1.1.

(1) Do the (Q) checks and services once each three months.

(2) Do the (S) checks and services twice each year, or each six months.

(3) Do the (A) checks and services once a year.

(4) Do the (B) checks and services once each two years.

(5) Do the (H) checks and services at the hour interval listed.

(6) Do the (MI) checks and services when the mileage of the vehicle reaches the amount listed.

WARNING

Drycleaning solvent, SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138°.

c. Make cleanup a part of your preventive maintenance. Dirt, grease, oil, and debris may cover up a serious problem. Wipe off excess grease and spilled oil. Use drycleaning solvent (SD-2) to clean metal surfaces. Use soap and water when you clean rubber or plastic material.

d. Watch for and correct anything that might cause a problem with the equipment. Some things you should watch for are:

(1) Bolts, nuts, and screws that are loose, missing, bent, or broken.

(2) Welds that are bad or broken.

(3) Electric wires and connectors that are bare, broken, or loose.

(4) Hoses and fluid lines that leak, or show signs of damage or wear.

e. You should know how fluid leaks affect the status of your equipment. Learn and be familiar with the following definitions of the types/classes of leakage. Remember — when in doubt, notify your supervisor!

Leakage definitions of PMCS are:

Class I	Seepage of fluid (indicated by wetness or discoloration not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.
Class III	Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course consideration should be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

Class III leaks should be corrected before releasing equipment for operation.

f. If the equipment doesn't work properly and you can't see what is wrong, refer to table 7-4 for troubleshooting instructions.

Table 7-1. Operator/Crew Preventive Maintenance Checks and Services
(CARRIER)

B-Before D-During A-After W-Weekly M-Monthly

Item no.	Interval					ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/available if:
	B	D	A	W	M		
						NOTE PERFORM WEEKLY AS WELL AS BEFORE PMCS IF: *a.* You are the assigned operator but have not operated carrier since the last weekly. *b.* You are operating the carrier for the first time.	
1						MAKE THE FOLLOWING WALK AROUND CHECKS: (Exterior of vehicle)	
	●					*a.* Check for evidence of leakage (oil, fuel, hydraulic fluid, or coolant on or under the carrier.	Class III leakage is evident (No fuel leakage allowed).
				●		*b.* Check tires for damage or low pressure. (Correct pressures is 75 psi).	
	●					*c.* Check for loose, missing, or damaged parts.	
2	●					RADIATOR Check coolant level. Fill to approximately 3/4 inch above baffle plate.	Class III leakage is evident.

Table 7-1. Operator/Crew Preventive Maintenance Checks and Services (CARRIER) – Continued

B-Before D-During A-After W-Weekly M-Monthly

Item no.	Interval					ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/available if:
	B	D	A	W	M		
3				●		BELTS Inspect fan, alternator, air compressor, steering pump, and water pump belts for frayed or deteriorated condition.	Belt is missing or broken.
4				●		BATTERIES Check level of electrolyte. If low, fill with clean water (distilled if possible) to the split ring. In freezing weather, run engine at least 15 minutes after adding water. (TM 9-6140-200-14).	
5						INSTRUMENTS Check for normal operating readings for the instruments as follows:	Pressure/temperature gages not within ranges specified.
		●				*a.* Engine Water temperature 160-200°F	Low air pressure buzzer sound while low air pressure indicator is within proper range.
		●				*b.* Engine Oil Pressure 35-45 psi	
		●				*c.* Engine Voltmeter 12.8-13.8 V	
		●				*d.* Air Pressure Gage 105-125 psi	
		●				*e.* Tachometer (full load) 2400 RPM	
6		●				LIGHTS Check for proper operation.	
7		●				BRAKES Check for proper operation.	Stopping ability impaired.
8						WINDSHIELD WIPER	
					●	*a.* Inspect blade and arm for damage and deterioration.	
		●				*b.* Check for proper operation.	
9		●				OUTRIGGERS Check for damage and proper operation.	Inoperative or Class III leakage.
10			●			AIR RESERVOIR Drain water and sediment.	
11	●					ENGINE Check oil level, add oil to full mark on dipstick.	
12	●					AIR CLEANER Check oil level, add oil to "Oil Level" mark.	
13		●				CONTROLS Check each control for proper operation.	Improper operation.
14					●	FUEL SEDIMENT BOWL Clean.	
15					●	OILDEX FILTER Clean glass cup.	

Table 7-1.1. Organizational Preventive Maintenance Checks and Services (CARRIER)

Legend

Q-Quarterly A-Annually H-Hours
S-Semiannually B-Biennially MI-Miles

Item no.	Interval						ITEM TO BE INSPECTED Procedure
	Q	S	A	B	H	MI	
							Note **PERFORM OPERATOR/CREW PCMS PRIOR TO OR IN CONJUNCTION WITH ORGANIZATIONAL PMCS.**
1							COOLING SYSTEM
	●						*a.* Inspect hoses and lines for evidence of leaks, abrasions, kinked or restricted areas, and loose mounting.
	●						*b.* Use hydrometer to measure coolant system freezing point. Add antifreeze as reqired to protect coolant system to lowest expected ambient temperature. (TB 750-651)

Table 7-1.1. Organizational Preventive Maintenance Checks and Services (CARRIER) – Continued

Legend

Q-Quarterly
S-Semiannually
A-Annually
B-Biennially
H-Hours
MI-Miles

Item no.	Interval						ITEM TO BE INSPECTED Procedure
	Q	S	A	B	H	MI	
2	●						FUEL SEDIMENT BOWL Clean, check for leaks, and tighten connections if necessary.
3	●						BELTS Adjust or replace as necessary.
4	●						BRAKES Check air system for leaks and damage. Adjust or replace as necessary.
5	●						ALCOHOL EVAPORATOR Keep jar 2/3 full, using pure methyl 188 proof alcohol. Alcohol should be free of any inhibitor. Check for proper operation.
6		●					ENGINE CLUTCH Adjust if needed.
7							TRANSMISSION
	●						*a.* Check air filter. Clean and/or replace element as required.
	●						*b.* Check oil level.
8							ENGINE
					100		*a.* Change oil and filters.
	●						*b.* Clean oildex filter.
9	●						LIGHTS Check for proper operation and/or damage, repair as necessary.
10					50		AIR CLEANER Disassemble, clean, change oil, and reassemble.

Page 7-46, key to figure 7-40, item 17. Change "tube" to "buzzer".

Page 7-57, paragraph 7-49d, line 3. Change "125 and 145" to "135 and 155".

Page 7-62, figure 7-54.

Change "LONG STUDS — TORQUE 200-210 FOOT POUNDS" to "LONG STUDS — TORQUE 200-208 FOOT POUNDS.

Change "*SHORT STUDS — TORQUE 90-95 FOOT POUNDS" to "*SHORT STUDS — TORQUE 150-155 FOOT POUNDS".

Page 7-63, paragraph 7-51*b*(2). Change "figure 8-56" to "figure 7-56".

Page B-1, Appendix B is superseded as follows:

APPENDIX B
BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

Section I. INTRODUCTION

B-1. Scope

This appendix lists items required by the operator for operation of the crane.

B-2. General

This list is divided into the following sections:

a. Basic Issue Items List – Section II. Not applicable.

b. Items Troop Installed or Authorized List – Section III. A list of items in alphabetical sequence, which at the discretion of the unit commander may accompany the crane. These items are NOT subject to turnin with the crane when evacuated.

B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Items Troop Installed or Authorized, Section III.

a. Source, Maintenance, and Recoverability Code(s) (SMR). Not applicable.

b. National Stock Number. This column indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the National item name and any additional description of the item required.

d. Unit of Measure (U/M). A 2 character alphabetical abbreviation indicating the amount or quantity of the item upon which the allowances are based, e. g., ft, ea, pr, etc.

e. Quantity Authorized. This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR code	(2) National stock number	(3) Description Ref. No. & Mfr. code	Usable on code	(4) Unit of meas	(5) Qty auth
	7520-00-559-9618	CASE: Manual		EA	1
	2590-00-505-6736	CASE: Rifle		EA	1
	4210-00-889-2221	EXTINGUISHER: Fire		EA	2

Page C-9, Group no. 0100, column (3), subcolumn H. Change "H" to "F"

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25B Organizational maintenance requirements for Cranes: Truck Mounted.

***TM 5–3810–288–12**

TECHNICAL MANUAL
No. 5–3810–288–12

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *26 February 1970*

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL FOR

CRANE, SHOVEL, TRUCK MOUNTED 20 TON, ¾ CU. YD. G.E.D., 6 x 6 (HARNISCHFEGER MODEL M320T)

FSN 3810–861–8088

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	II.	Description and data	1–3	1–1
CHAPTER	2.	INSTALLATION AND OPERATING INSTRUCTIONS		
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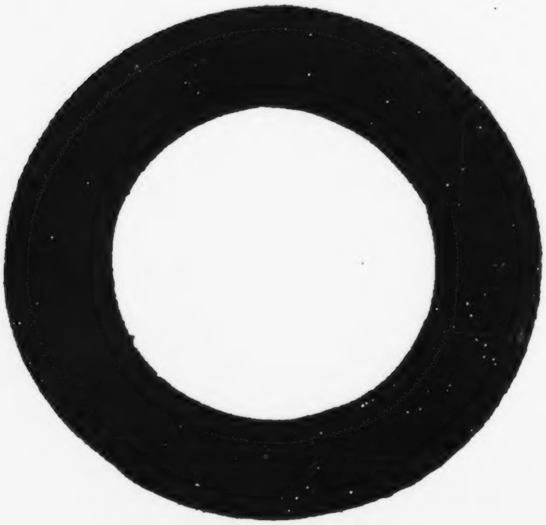
***This manual supersedes that portion of TM 5–3810–288–15, 8 August 1969, that pertains to operator and organizational maintenance.**



PART ONE
CRANE UPPER

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1–1. Scope

a. These instructions are published for the use of the personnel to whom the Harnischfeger truck crane Model M320T is issued. They provide information on the operation, lubrication, and preventive maintenance services of the equipment, accessories, components, and attachments.

b. This manual is divided into two parts. Part One is primarily instructions for the operation of the upper (revolving frame portion) of the machine. Part Two is primarily for the operation of the lower (carrier portion) of the machine. Operators and maintenance personnel should read the instructions provided in both parts of this manual before operating or servicing the equipment.

c. Appendix A is a list of publications applicable to this manual. Appendix B is the Basic Issue Items authorized for use by the operator. Appendix C is the Maintenance Allocation Chart.

d. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

1–2. Forms and Records

a. DA Forms and records used for equipment maintenance will be only those prescribed by TM 38–750, Army Equipment Record Procedures.

b. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Blvd. St. Louis, Mo. 63120.

Section II. DESCRIPTION AND DATA

1–3. Description.

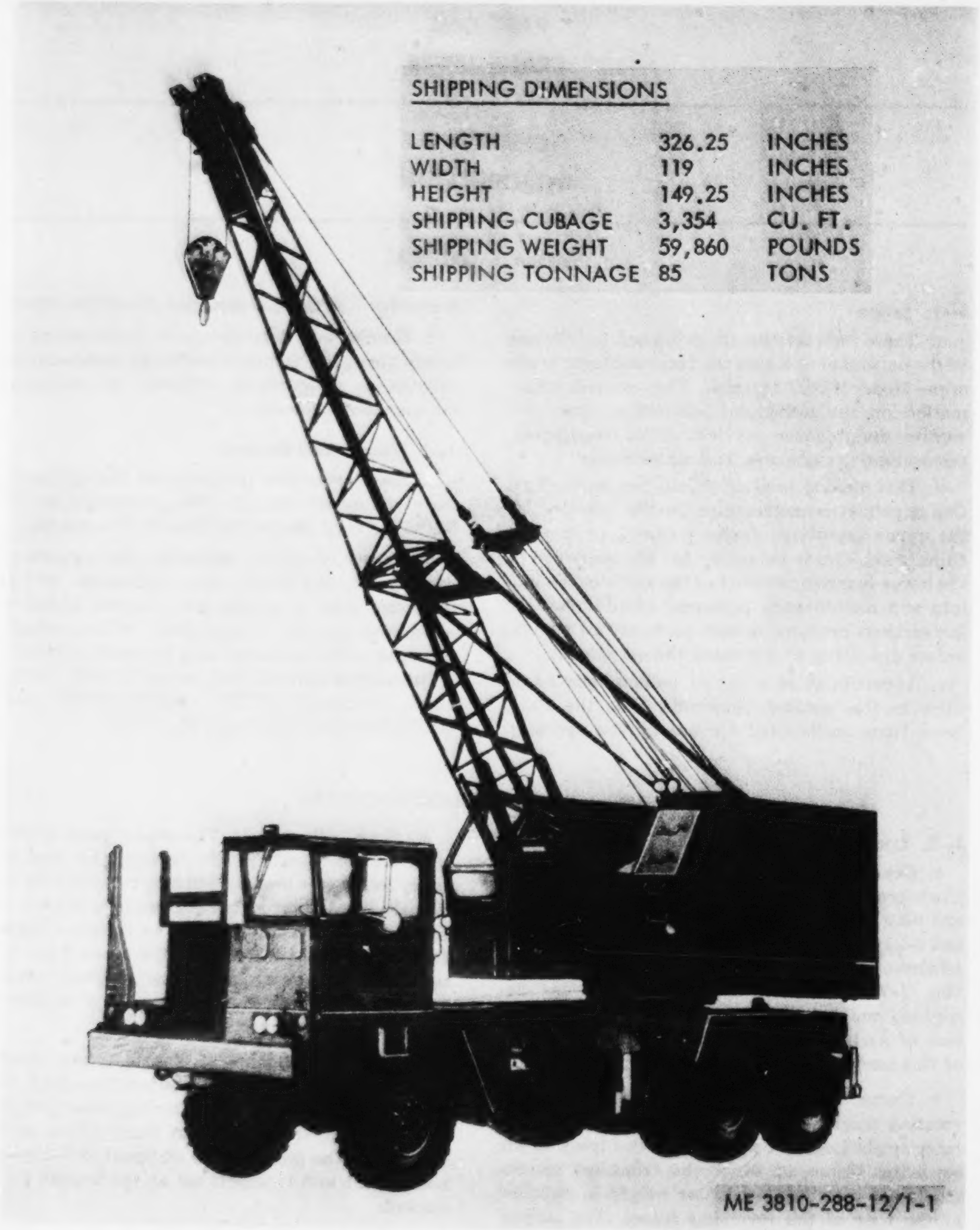
a. General. The Harnischfeger Model M320T truck crane is designed for universal operation, and may be converted for use as a crane (fig. 1–1 and 1–2), clamshell (fig. 1–3), dragline (fig. 1–4), piledriver (fig. 1–5), backhoe (fig. 1–6), or shovel (fig. 1–7). The front-end attachments are described, and detailed instructions for the operation of each attachment are given in Chapter 2 of this manual. The military load class is E–29.

b. Crane. The crane includes a revolving frame, rotating machinery, gasoline engine, and an operator's cab. Lugs are provided at the front of the revolving frame, to which the front-end attachments are installed. A counter-weight is installed at the rear of the revolving frame. The carrier on which the crane is mounted is described in paragraph 5–3 of this manual.

c. Crane attachment. The crane boom is used with a hook block to lift, swing, and position heavy loads. It is used also in conjunction with the clamshell and dragline buckets, and the piledriver. The clamshell bucket (fig. 1–3) or dragline bucket (fig. 1–4) may be installed on the crane boom for excavating or moving loose material. Boom inserts are used to increase the boom length, or to extend the working range of the crane.

d. Piledriver attachment. The piledriver attachment (fig. 1–5 is used in conjunction with the crane boom and is used for driving piling into the ground in the construction of foundations, piers, and bases. The piledriver is attached to the crane boom point and is supported at the bottom by a catwalk.

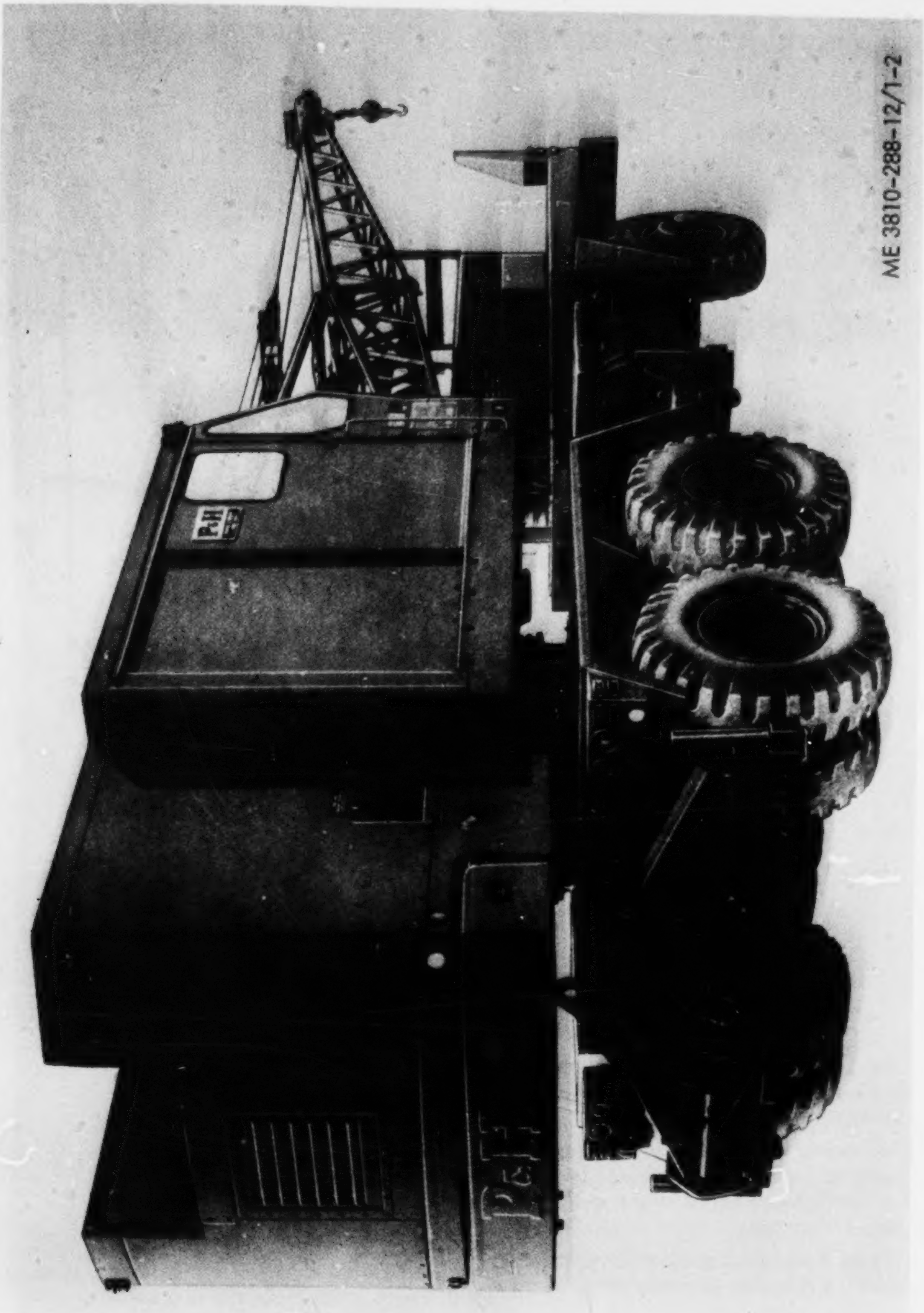
e. Backhoe attachment. The backhoe attachment (fig. 1–6) is designed to work below the



SHIPPING DIMENSIONS

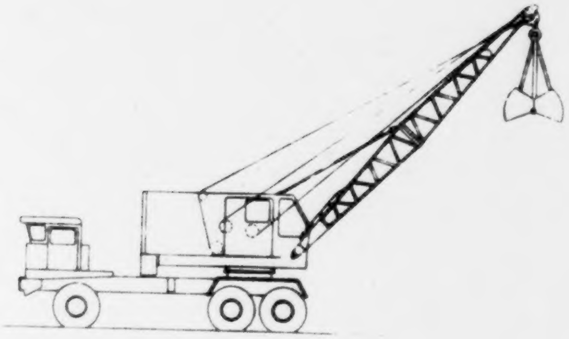
LENGTH	326.25	INCHES
WIDTH	119	INCHES
HEIGHT	149.25	INCHES
SHIPPING CUBAGE	3,354	CU. FT.
SHIPPING WEIGHT	59,860	POUNDS
SHIPPING TONNAGE	85	TONS

Figure 1-1. Truck crane, Model M320T, with crane attachment, front three-quarter view and shipping dimensions.



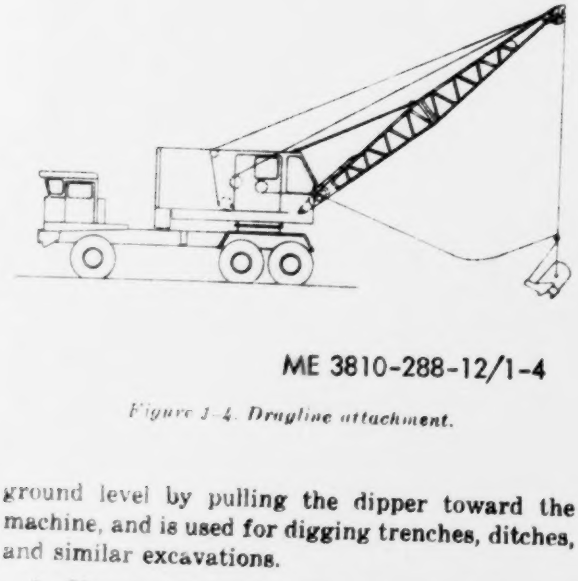
ME 3810-288-12/1-2

Figure 1-2. Truck crane, Model M320T, with crane attachment, rear three-quarter view.



ME 3810-288-12/1-3

Figure 1-3. Clamshell attachment.



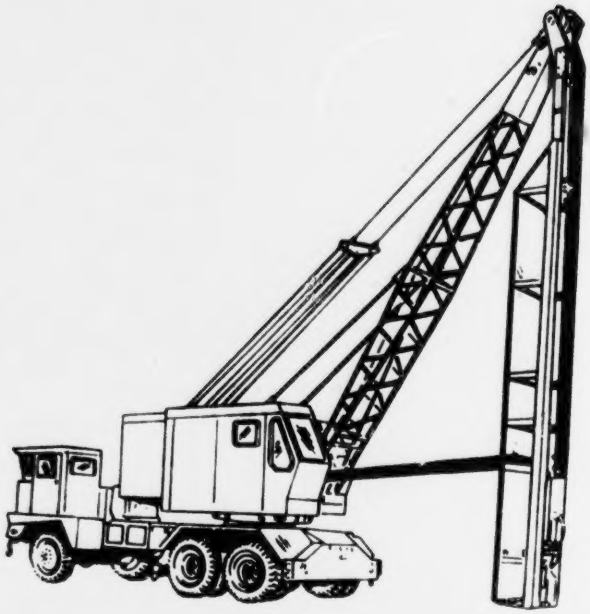
ME 3810-288-12/1-4

Figure 1-4. Dragline attachment.

ground level by pulling the dipper toward the machine, and is used for digging trenches, ditches, and similar excavations.

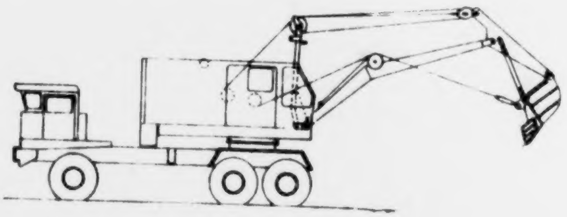
f. Shovel attachment. The shovel attachment (fig. 1-7) is designed to work above ground level by lifting the dipper upward and outward, and is used for digging into the side of a hill or bank.

g. Engine. Power for operating the truck crane and its various attachments is supplied by a 6-cylinder, overhead valve, 4-cycle, Waukesha, Model 135-GKC, gasoline Engine (fig. 1-8), mounted at the rear of the revolving frame.



ME 3810-288-12/1-5

Figure 1-5. Piledriver attachment.



ME 3810-288-12/1-6

Figure 1-6. Backhoe attachment.

1-4. Identification and Tabulated Data

a. Identification. Figure 1-9 shows the location of all major instruction and identification plates Each such plate is numbered and illustrated as a portion of this illustration.

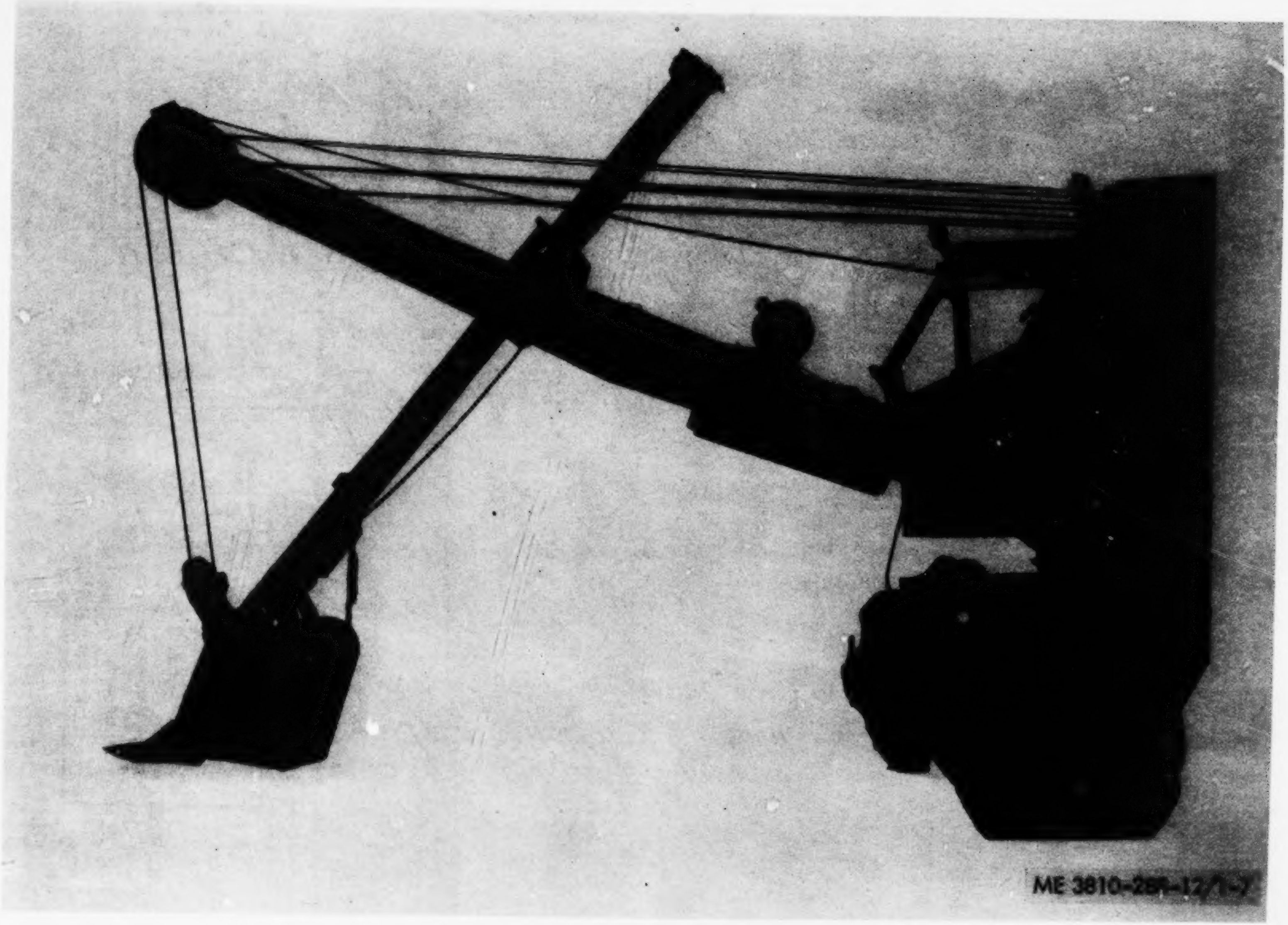

ME 3810-288-12/1-7

Figure 1-7. Shovel attachment.

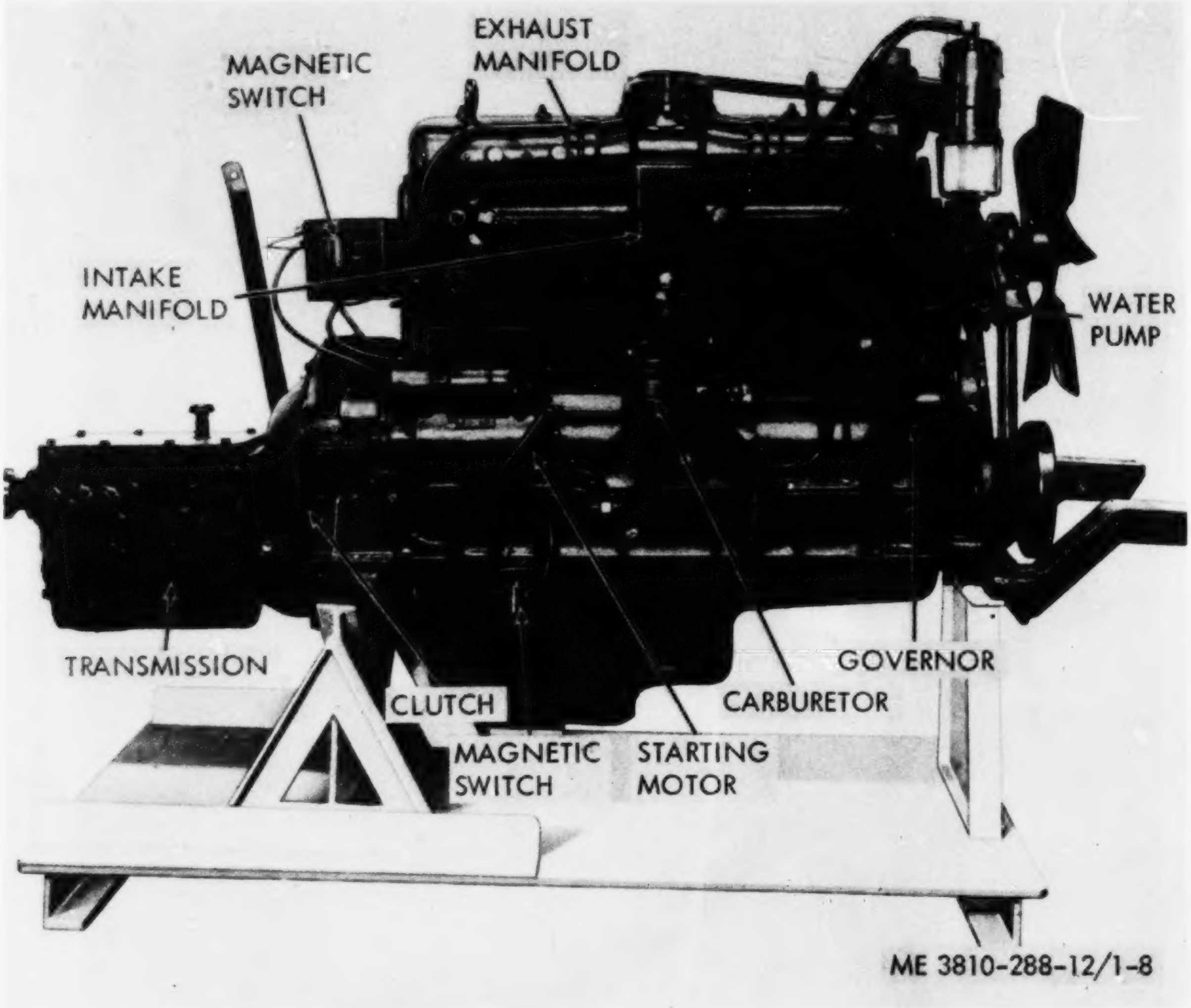
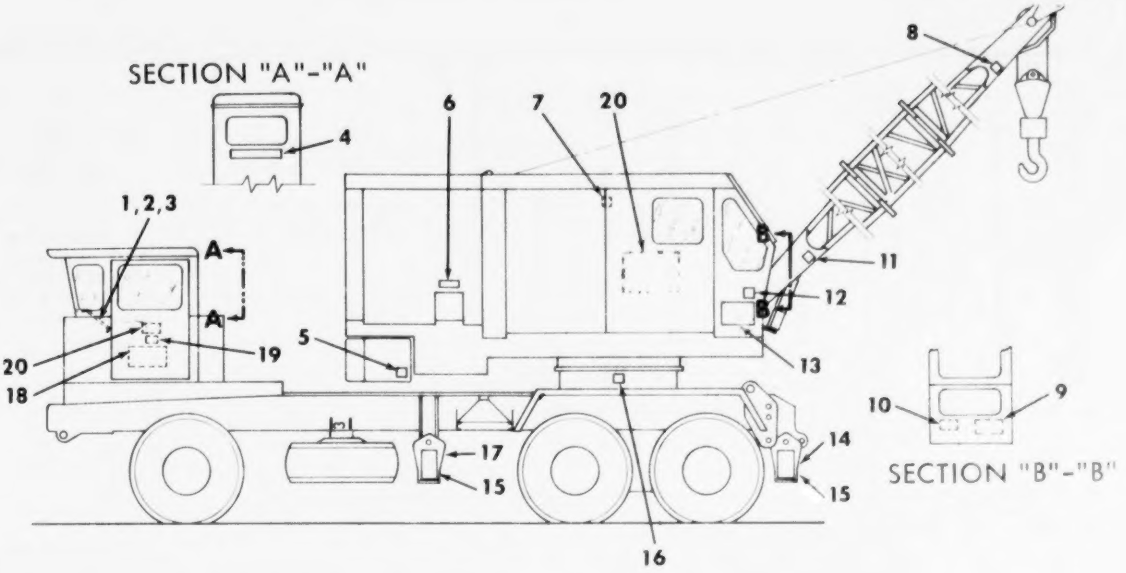
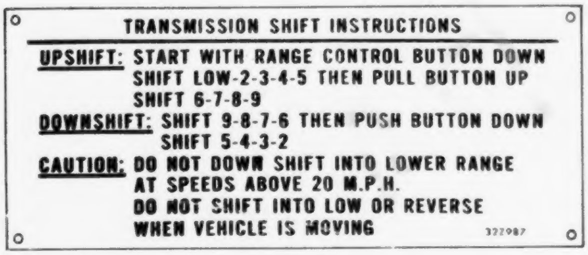

EXHAUST MANIFOLD
MAGNETIC SWITCH
INTAKE MANIFOLD
WATER PUMP
TRANSMISSION
GOVERNOR
CLUTCH
CARBURETOR
MAGNETIC SWITCH
STARTING MOTOR
ME 3810-288-12/1-8

Figure 1-8. Crane engine, with transmission.


SECTION "A"-"A"
4
6
7
20
8
1,2,3
A
A
B
11
12
B
13
20
19
18
5
17
15
14
15
16
10
9
SECTION "B"-"B"


TRANSMISSION SHIFT INSTRUCTIONS

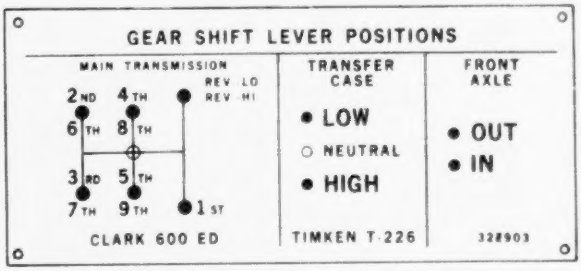
UPSHIFT: START WITH RANGE CONTROL BUTTON DOWN
SHIFT LOW-2-3-4-5 THEN PULL BUTTON UP
SHIFT 6-7-8-9

DOWNSHIFT: SHIFT 9-8-7-6 THEN PUSH BUTTON DOWN
SHIFT 5-4-3-2

CAUTION: DO NOT DOWN SHIFT INTO LOWER RANGE
AT SPEEDS ABOVE 20 M.P.H.
DO NOT SHIFT INTO LOW OR REVERSE
WHEN VEHICLE IS MOVING

322987

REF. 1


GEAR SHIFT LEVER POSITIONS

MAIN TRANSMISSION
REV LO
REV HI
2ND
4TH
6TH
8TH
3RD
5TH
7TH
9TH
1ST

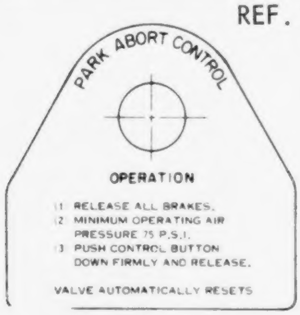
CLARK 600 ED

TRANSFER CASE
● LOW
○ NEUTRAL
● HIGH
TIMKEN T-226

FRONT AXLE
● OUT
● IN

328903

REF. 2

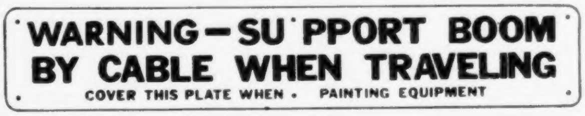

PARK ABORT CONTROL

OPERATION

(1) RELEASE ALL BRAKES.
(2) MINIMUM OPERATING AIR PRESSURE 75 P.S.I.
(3) PUSH CONTROL BUTTON DOWN FIRMLY AND RELEASE.

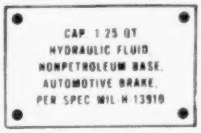
VALVE AUTOMATICALLY RESETS

REF. 3

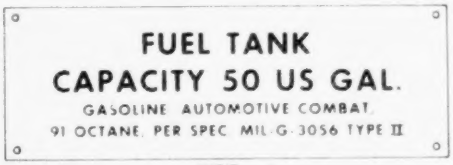

WARNING—SUPPORT BOOM BY CABLE WHEN TRAVELING

COVER THIS PLATE WHEN PAINTING EQUIPMENT

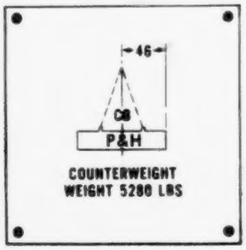
REF. 4


CAP 1 25 QT
HYDRAULIC FLUID
NONPETROLEUM BASE,
AUTOMOTIVE BRAKE,
PER SPEC MIL-H-13910

REF. 7

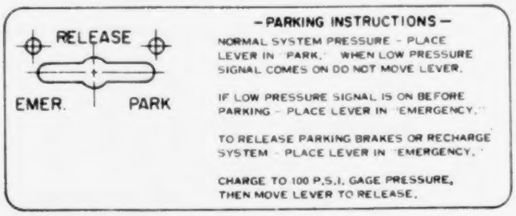

FUEL TANK
CAPACITY 50 US GAL.
GASOLINE AUTOMOTIVE COMBAT
91 OCTANE, PER SPEC MIL-G-3056 TYPE II

REF. 6



COUNTERWEIGHT
WEIGHT 5280 LBS

REF. 5


RELEASE
EMER.
PARK

—PARKING INSTRUCTIONS—

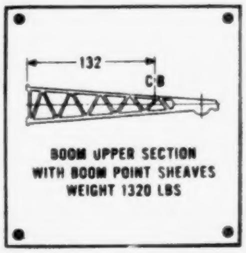
NORMAL SYSTEM PRESSURE - PLACE LEVER IN "PARK." WHEN LOW PRESSURE SIGNAL COMES ON DO NOT MOVE LEVER.

IF LOW PRESSURE SIGNAL IS ON BEFORE PARKING - PLACE LEVER IN "EMERGENCY."

TO RELEASE PARKING BRAKES OR RECHARGE SYSTEM - PLACE LEVER IN "EMERGENCY."

CHARGE TO 100 P.S.I. GAGE PRESSURE, THEN MOVE LEVER TO RELEASE.

REF. 3

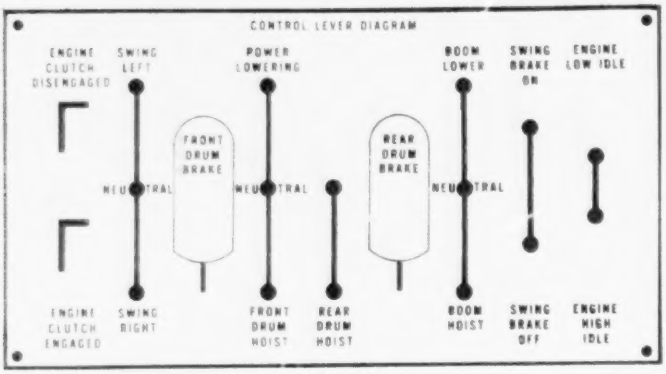


BOOM UPPER SECTION
WITH BOOM POINT SHEAVES
WEIGHT 1320 LBS

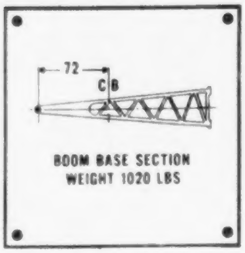
REF. 8

ME 3810-288-12/1-9①

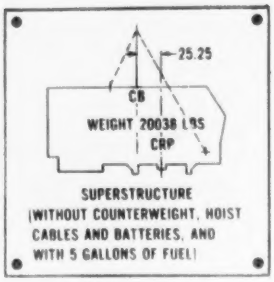
Figure 1-9. Identification and instruction plates (Sheet 1 of 4).


CONTROL LEVER DIAGRAM
ENGINE CLUTCH DISENGAGED
SWING LEFT
POWER LOWERING
BOOM LOWER
SWING BRAKE ON
ENGINE LOW IDLE
FRONT DRUM BRAKE
REAR DRUM BRAKE
NEUTRAL
NEUTRAL
NEUTRAL
ENGINE CLUTCH ENGAGED
SWING RIGHT
FRONT DRUM HOIST
REAR DRUM HOIST
BOOM HOIST
SWING BRAKE OFF
ENGINE HIGH IDLE

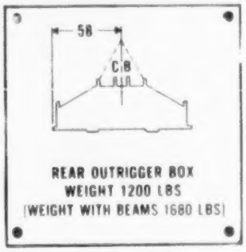
REF. 9


72
C B
BOOM BASE SECTION
WEIGHT 1020 LBS

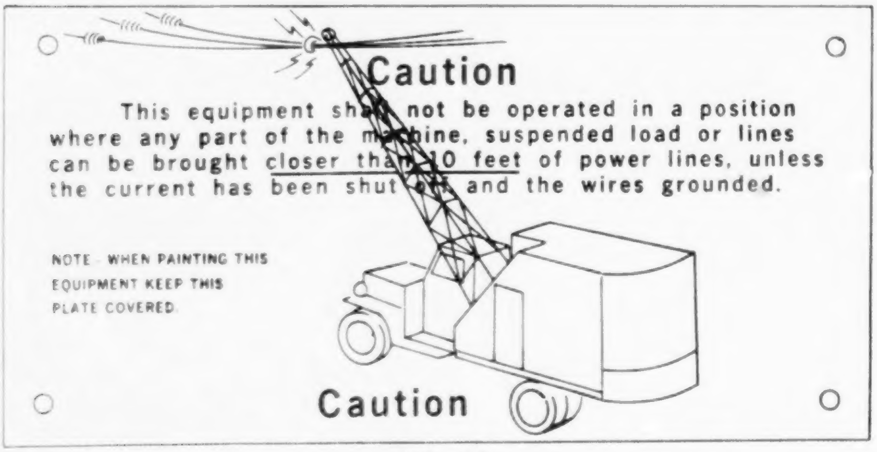
REF. 11


25.25
CB
WEIGHT 20038 LBS
CRP
SUPERSTRUCTURE
(WITHOUT COUNTERWEIGHT, HOIST CABLES AND BATTERIES, AND WITH 5 GALLONS OF FUEL)

REF. 12


58
C B
REAR OUTRIGGER BOX
WEIGHT 1200 LBS
(WEIGHT WITH BEAMS 1680 LBS)

REF. 14

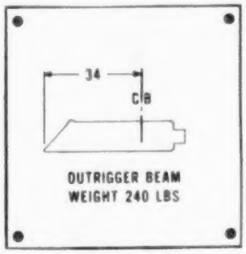

Caution

This equipment shall not be operated in a position where any part of the machine, suspended load or lines can be brought closer than 10 feet of power lines, unless the current has been shut off and the wires grounded.

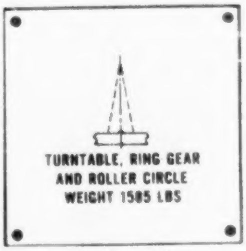
NOTE - WHEN PAINTING THIS EQUIPMENT KEEP THIS PLATE COVERED.

Caution

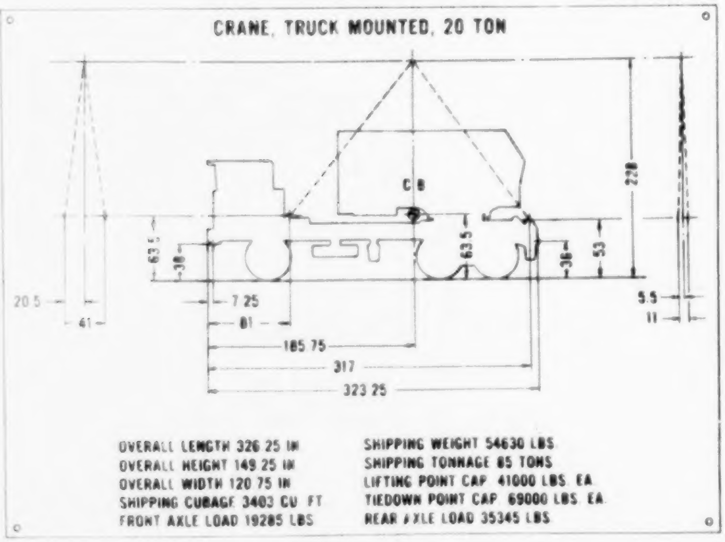
REF. 10


34
C B
OUTRIGGER BEAM
WEIGHT 240 LBS

REF. 15


TURNTABLE, RING GEAR AND ROLLER CIRCLE
WEIGHT 1585 LBS

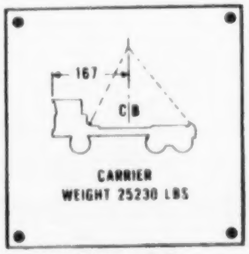
REF. 16


CRANE, TRUCK MOUNTED, 20 TON
C B
228
63.5
38
63.5
36
53
20.5
41
7.25
81
185.75
317
323.25
5.5
11

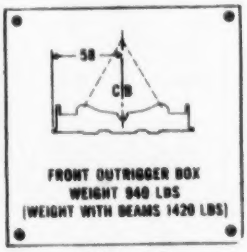
OVERALL LENGTH 326.25 IN
OVERALL HEIGHT 149.25 IN
OVERALL WIDTH 120.75 IN
SHIPPING CUBAGE 3403 CU. FT
FRONT AXLE LOAD 19285 LBS

SHIPPING WEIGHT 54630 LBS
SHIPPING TONNAGE 85 TONS
LIFTING POINT CAP. 41000 LBS. EA
TIEDOWN POINT CAP. 69000 LBS. EA
REAR AXLE LOAD 35345 LBS

REF. 13


167
C B
CARRIER
WEIGHT 25230 LBS

REF. 17


58
C B
FRONT OUTRIGGER BOX
WEIGHT 940 LBS
(WEIGHT WITH BEAMS 1420 LBS)

REF. 19

ME 3810-288-12/1-9②

Figure 1-9. Identification and instruction plates (Sheet 2 of 4).

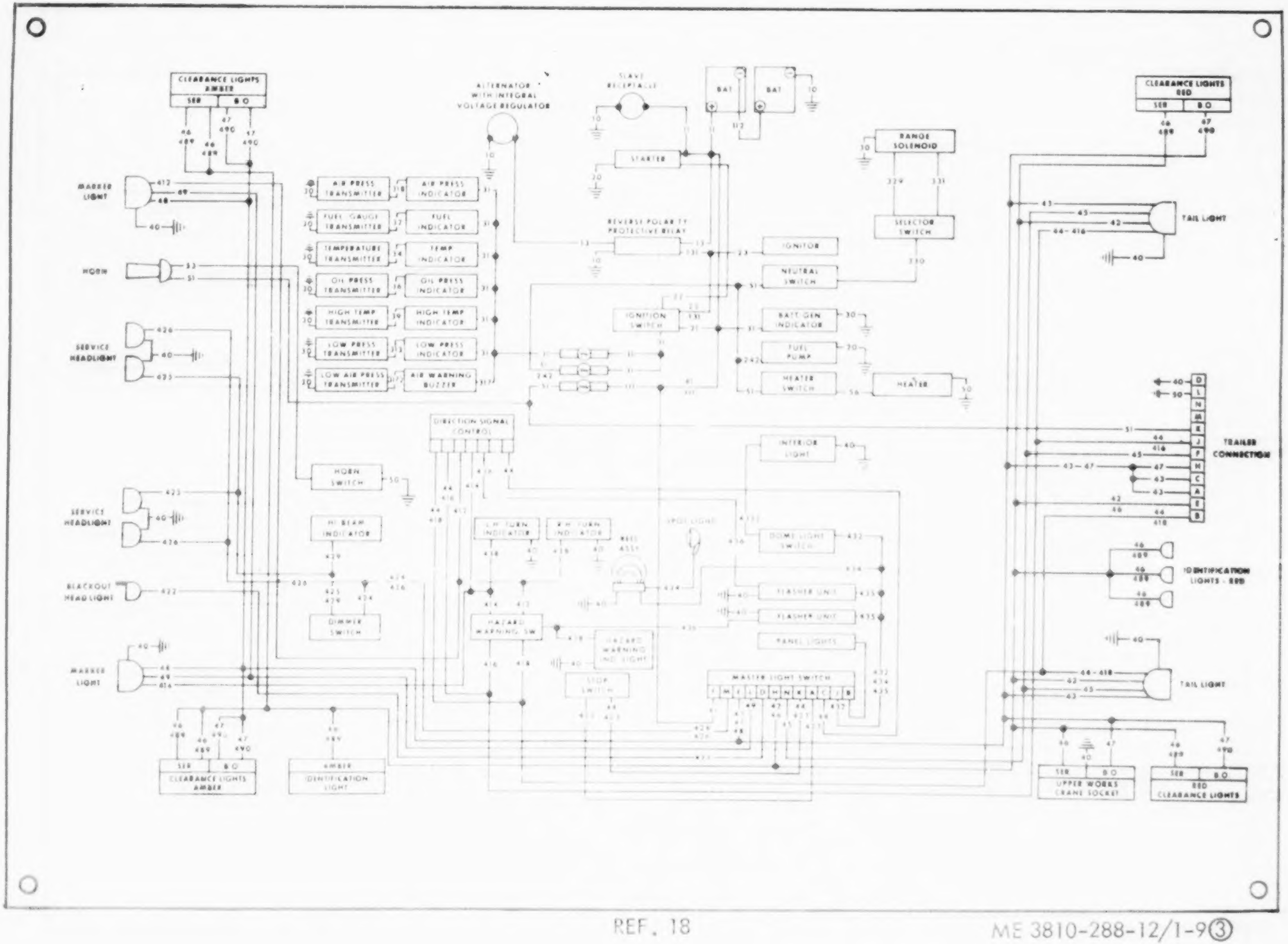
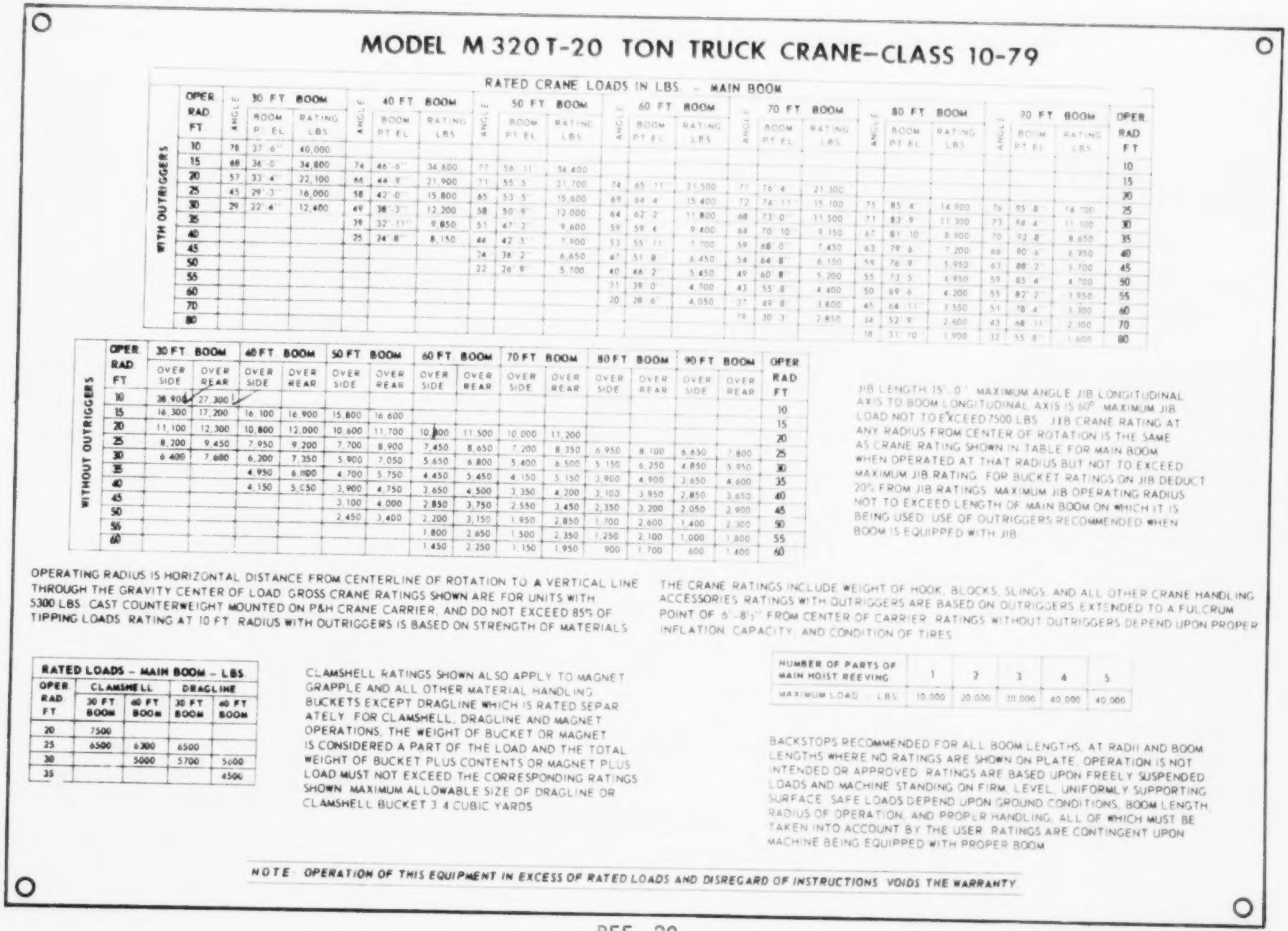

CLEARANCE LIGHTS AMBER
SER
B O
MARKER LIGHT
HORN
SERVICE HEADLIGHT
SERVICE HEADLIGHT
BLACKOUT HEADLIGHT
MARKER LIGHT
CLEARANCE LIGHTS AMBER
AMBER IDENTIFICATION LIGHT
ALTERNATOR WITH INTEGRAL VOLTAGE REGULATOR
AIR PRESS TRANSMITTER
AIR PRESS INDICATOR
FUEL GAUGE TRANSMITTER
FUEL INDICATOR
TEMPERATURE TRANSMITTER
TEMP INDICATOR
OIL PRESS TRANSMITTER
OIL PRESS INDICATOR
HIGH TEMP TRANSMITTER
HIGH TEMP INDICATOR
LOW PRESS TRANSMITTER
LOW PRESS INDICATOR
LOW AIR PRESS TRANSMITTER
AIR WARNING BUZZER
DIRECTION SIGNAL CONTROL
HORN SWITCH
HI BEAM INDICATOR
DIMMER SWITCH
L.H. TURN INDICATOR
R.H. TURN INDICATOR
REEL ASSY
HAZARD WARNING SW
HAZARD WARNING IND LIGHT
STOP SWITCH
SLAVE RECEPTACLE
STARTER
BAT
BAT
REVERSE POLARITY PROTECTIVE RELAY
IGNITION SWITCH
IGNITOR
NEUTRAL SWITCH
BATT GEN INDICATOR
FUEL PUMP
HEATER SWITCH
HEATER
RANGE SOLENOID
SELECTOR SWITCH
INTERIOR LIGHT
SPOT LIGHT
DOME LIGHT SWITCH
FLASHER UNIT
FLASHER UNIT
PANEL LIGHTS
MASTER LIGHT SWITCH
CLEARANCE LIGHTS RED
TAIL LIGHT
TRAILER CONNECTION
IDENTIFICATION LIGHTS - RED
TAIL LIGHT
UPPER WORKS CRANE SOCKET
RED CLEARANCE LIGHTS
REF. 18
ME 3810-288-12/1-9③

Figure 1-9. Identification and instruction plates (Sheet 3 of 4).



MODEL M 320T-20 TON TRUCK CRANE—CLASS 10-79

RATED CRANE LOADS IN LBS. – MAIN BOOM

	OPER RAD FT	ANGLE	30 FT BOOM		ANGLE	40 FT BOOM		ANGLE	50 FT BOOM		ANGLE	60 FT BOOM		ANGLE	70 FT BOOM		ANGLE	80 FT BOOM		ANGLE	90 FT BOOM		OPER RAD FT
			BOOM PT EL	RATING LBS		BOOM PT EL	RATING LBS		BOOM PT EL	RATING LBS		BOOM PT EL	RATING LBS		BOOM PT EL	RATING LBS		BOOM PT EL	RATING LBS		BOOM PT EL	RATING LBS	
WITH OUTRIGGERS	10	78	37'6"	40,000																			10
	15	68	36'0"	34,800	74	46'6"	34,600	77	56'11"	34,400													15
	20	57	33'4"	22,100	66	44'9"	21,900	71	55'5"	21,700	74	65'11"	21,500	77	76'4"	21,300							20
	25	45	29'3"	16,000	58	42'0"	15,800	65	53'5"	15,600	69	64'4"	15,400	72	74'11"	15,100	75	85'4"	14,900	76	95'8"	14,700	25
	30	29	22'4"	12,400	49	38'3"	12,200	58	50'9"	12,000	64	62'2"	11,800	68	73'0"	11,500	71	83'9"	11,300	73	94'4"	11,100	30
	35				39	32'11"	9,850	51	47'2"	9,600	59	59'4"	9,400	64	70'10"	9,150	67	81'10"	8,900	70	92'8"	8,650	35
	40				25	24'8"	8,150	44	42'5"	7,900	53	55'11"	7,700	59	68'0"	7,450	63	79'6"	7,200	66	90'6"	6,950	40
	45							34	36'2"	6,650	47	51'8"	6,450	54	64'8"	6,150	59	76'9"	5,950	63	88'2"	5,700	45
	50							22	26'9"	5,700	40	46'2"	5,450	49	60'8"	5,200	55	73'5"	4,950	59	85'4"	4,700	50
	55										31	39'0"	4,700	43	55'8"	4,400	50	69'6"	4,200	55	82'2"	3,950	55
	60										20	28'6"	4,050	37	49'8"	3,800	45	64'11"	3,550	51	78'4"	3,300	60
	70													19	30'3"	2,850	34	52'9"	2,600	43	68'11"	2,300	70
	80																18	31'10"	1,900	32	55'8"	1,600	80

	OPER RAD FT	30 FT BOOM		40 FT BOOM		50 FT BOOM		60 FT BOOM		70 FT BOOM		80 FT BOOM		90 FT BOOM		OPER RAD FT
		OVER SIDE	OVER REAR	OVER SIDE	OVER REAR	OVER SIDE	OVER REAR	OVER SIDE	OVER REAR	OVER SIDE	OVER REAR	OVER SIDE	OVER REAR	OVER SIDE	OVER REAR	
WITHOUT OUTRIGGERS	10	28,900	27,300													10
	15	16,300	17,200	16,100	16,900	15,800	16,600									15
	20	11,100	12,300	10,800	12,000	10,600	11,700	10,800	11,500	10,000	11,200					20
	25	8,200	9,450	7,950	9,200	7,700	8,900	7,450	8,650	7,200	8,350	6,950	8,100	6,650	7,800	25
	30	6,400	7,600	6,200	7,350	5,900	7,050	5,650	6,800	5,400	6,500	5,150	6,250	4,850	5,950	30
	35			4,950	6,100	4,700	5,750	4,450	5,450	4,150	5,150	3,900	4,900	3,650	4,600	35
	40			4,150	5,050	3,900	4,750	3,650	4,500	3,350	4,200	3,100	3,950	2,850	3,650	40
	45					3,100	4,000	2,850	3,750	2,550	3,450	2,350	3,200	2,050	2,900	45
	50					2,450	3,400	2,200	3,150	1,950	2,850	1,700	2,600	1,400	2,300	50
	55							1,800	2,650	1,500	2,350	1,250	2,100	1,000	1,800	55
	60							1,450	2,250	1,150	1,950	900	1,700	600	1,400	60

JIB LENGTH 15'-0". MAXIMUM ANGLE JIB LONGITUDINAL AXIS TO BOOM LONGITUDINAL AXIS IS 60°. MAXIMUM JIB LOAD NOT TO EXCEED 7500 LBS. JIB CRANE RATING AT ANY RADIUS FROM CENTER OF ROTATION IS THE SAME AS CRANE RATING SHOWN IN TABLE FOR MAIN BOOM WHEN OPERATED AT THAT RADIUS BUT NOT TO EXCEED MAXIMUM JIB RATING. FOR BUCKET RATINGS ON JIB DEDUCT 20% FROM JIB RATINGS. MAXIMUM JIB OPERATING RADIUS NOT TO EXCEED LENGTH OF MAIN BOOM ON WHICH IT IS BEING USED. USE OF OUTRIGGERS RECOMMENDED WHEN BOOM IS EQUIPPED WITH JIB.

OPERATING RADIUS IS HORIZONTAL DISTANCE FROM CENTERLINE OF ROTATION TO A VERTICAL LINE THROUGH THE GRAVITY CENTER OF LOAD. GROSS CRANE RATINGS SHOWN ARE FOR UNITS WITH 5300 LBS. CAST COUNTERWEIGHT MOUNTED ON P&H CRANE CARRIER, AND DO NOT EXCEED 85% OF TIPPING LOADS. RATING AT 10 FT. RADIUS WITH OUTRIGGERS IS BASED ON STRENGTH OF MATERIALS.

THE CRANE RATINGS INCLUDE WEIGHT OF HOOK, BLOCKS, SLINGS, AND ALL OTHER CRANE HANDLING ACCESSORIES. RATINGS WITH OUTRIGGERS ARE BASED ON OUTRIGGERS EXTENDED TO A FULCRUM POINT OF 6'-8½" FROM CENTER OF CARRIER. RATINGS WITHOUT OUTRIGGERS DEPEND UPON PROPER INFLATION, CAPACITY, AND CONDITION OF TIRES.

RATED LOADS – MAIN BOOM – LBS.				
OPER RAD FT	CLAMSHELL		DRAGLINE	
	30 FT BOOM	40 FT BOOM	30 FT BOOM	40 FT BOOM
20	7500			
25	6500	6300	6500	
30		5000	5700	5600
35				4500

CLAMSHELL RATINGS SHOWN ALSO APPLY TO MAGNET, GRAPPLE AND ALL OTHER MATERIAL HANDLING BUCKETS EXCEPT DRAGLINE WHICH IS RATED SEPARATELY. FOR CLAMSHELL, DRAGLINE AND MAGNET OPERATIONS, THE WEIGHT OF BUCKET OR MAGNET IS CONSIDERED A PART OF THE LOAD AND THE TOTAL WEIGHT OF BUCKET PLUS CONTENTS OR MAGNET PLUS LOAD MUST NOT EXCEED THE CORRESPONDING RATINGS SHOWN. MAXIMUM ALLOWABLE SIZE OF DRAGLINE OR CLAMSHELL BUCKET 3/4 CUBIC YARDS.

NUMBER OF PARTS OF MAIN HOIST REEVING	1	2	3	4	5
MAXIMUM LOAD – LBS.	10,000	20,000	30,000	40,000	40,000

BACKSTOPS RECOMMENDED FOR ALL BOOM LENGTHS. AT RADII AND BOOM LENGTHS WHERE NO RATINGS ARE SHOWN ON PLATE, OPERATION IS NOT INTENDED OR APPROVED. RATINGS ARE BASED UPON FREELY SUSPENDED LOADS AND MACHINE STANDING ON FIRM, LEVEL, UNIFORMLY SUPPORTING SURFACE. SAFE LOADS DEPEND UPON GROUND CONDITIONS, BOOM LENGTH, RADIUS OF OPERATION, AND PROPER HANDLING, ALL OF WHICH MUST BE TAKEN INTO ACCOUNT BY THE USER. RATINGS ARE CONTINGENT UPON MACHINE BEING EQUIPPED WITH PROPER BOOM.

NOTE OPERATION OF THIS EQUIPMENT IN EXCESS OF RATED LOADS AND DISREGARD OF INSTRUCTIONS VOIDS THE WARRANTY

REF. 20

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Figure 1-9. Identification and instruction plates (Sheet 4 of 4).

b. *Tabulated Data.*

(1) *Truck crane.*

Manufacturer	Harnischfeger Corporation
Model	M320T

(2) *Carrier engine.*

Manufacturer	Waukesha Motor Company
Model	F-817-G
Number of cylinders	6
Horsepower	209 at 2400 rpm
Displacement	817 cubic inches
Ignition timing	Top dead center
Governed speed	2400 rpm
Low idle speed	500 rpm
Maximum oil pressure	40 pounds per square inch
Intake valve tappet clearance	0.011 to 0.013 inch
Exhaust valve tappet clearance	0.024 to 0.026 inch
Electrical system	24 volts, negative ground

(3) *Crane engine.*

Manufacturer	Waukesha Motor Company
Model	135-GKC
Ignition timing	Top dead center
Number of cylinders	6
Horsepower	94 horsepower at 1800 rpm
Intake valve tappet clearance	0.012 to 0.014 inch
Exhaust valve tappet clearance	0.023 to 0.025 inch
Displacement	426 cubic inches
Governed speed under load	1800 rpm
Low idle speed	500 rpm
Maximum oil pressure at governed speed	45 psi (approx.)
Electrical system	24 volts, negative ground

(4) *Dimensions and transportation data.* (fig. 1-9).

Overall length, with boom in travel position	536 inches
Overall length, without boom	326.25 inches
Overall width	119 inches
Overall height, at gantry sheave shaft	149.25 inches
Shipping cubage	3,354 cubic feet
Shipping tonnage	85 tons

(5) *Approximate weights.*

Truck crane with counterweight and boom	59,860 pounds
Truck crane with counterweight and without boom	55,380 pounds
Carrier	29,640 pounds
Crane upper with counterweight	25,740 pounds
Crane upper without counterweight	20,360 pounds
Boom tip section with two guy lines attached	1,460 pounds
Boom insert, 10 foot	500 pounds
Guy lines, 10 foot, set of two	100 pounds
Boom base section	1,020 pounds
Upper spreader	220 pounds
Hook block	480 pounds
Boom backstops with pins	1,000 pounds
Fairlead	732 pounds

(6) *Speeds (full throttle and full load).*

Rear drum shaft	48.4 rpm
Rear drum shaft lowering	Gravity
Front drum shaft raising	48.4 rpm
Front drum shaft lowering	26.175 rpm

Front drum line speed, lowering	92.4 feet per minute
Boom hoist drum shaft	96.8 rpm
Boom hoist drum shaft, lowering	45.8 rpm
Boom hoist drum line speed, lowering	112.5 feet per minute
Revolving frame rotation	4.06 rpm

(7) *Rated capacities.*

Crane	20 tons (rating plate, fig. 1-9)
Clamshell	¾ cubic yard
Dragline	¾ cubic yard
Backhoe	¾ cubic yard
Shovel	¾ cubic yard
Rear drum line pull, sea level	15,900 pounds
Rear drum line pull, 5000 feet altitude	12,550 pounds
Front drum line pull, sea level	15,400 pounds
Front drum line pull, 5000 feet altitude	12,200 pounds
Boom hoist drum line pull	7,000 pounds

(8) *Fuel, water, oil and grease capacities, carrier.*

Engine fuel tank	75 gallons
Cooling system	15 gallons
Crankcase	28 quarts
Transmission	8 quarts
Drop box	4 quarts
Transfer case	8½ pints
Front axle	11 quarts
Front rear axle	11½ quarts
Rear rear axle	11 quarts
Steering gear and tank	7 pints

(9) *Crane fuel, water, and oil capacities.*

Engine fuel tank	50 gallons
Cooling system	9½ gallons
Crankcase	16 quarts
Transmission	9 pints
Gear and chain case	18 gallons
Hydraulic system reservoir	3 quarts

(10) *Crane lifting capacities.* Refer to figure 1-9 for crane lifting capacities.

(11) *Crane working ranges.* See figure 1-10 for crane working ranges.

(12) *Clamshell working ranges.* See figure 1-11 for clamshell working ranges.

(13) *Dragline working ranges.* See figure 1-12 for dragline working ranges.

(14) *Backhoe working ranges.* See figure 1-13 for backhoe working ranges.

(15) *Cable specifications.* Refer to table 1-1 for cable lengths for each of the front-end attachments.

(16) *Bridge weight classification.* The bridge weight classification is E-29.

(17) *Crane wiring diagram.* Refer to figure 1-14.

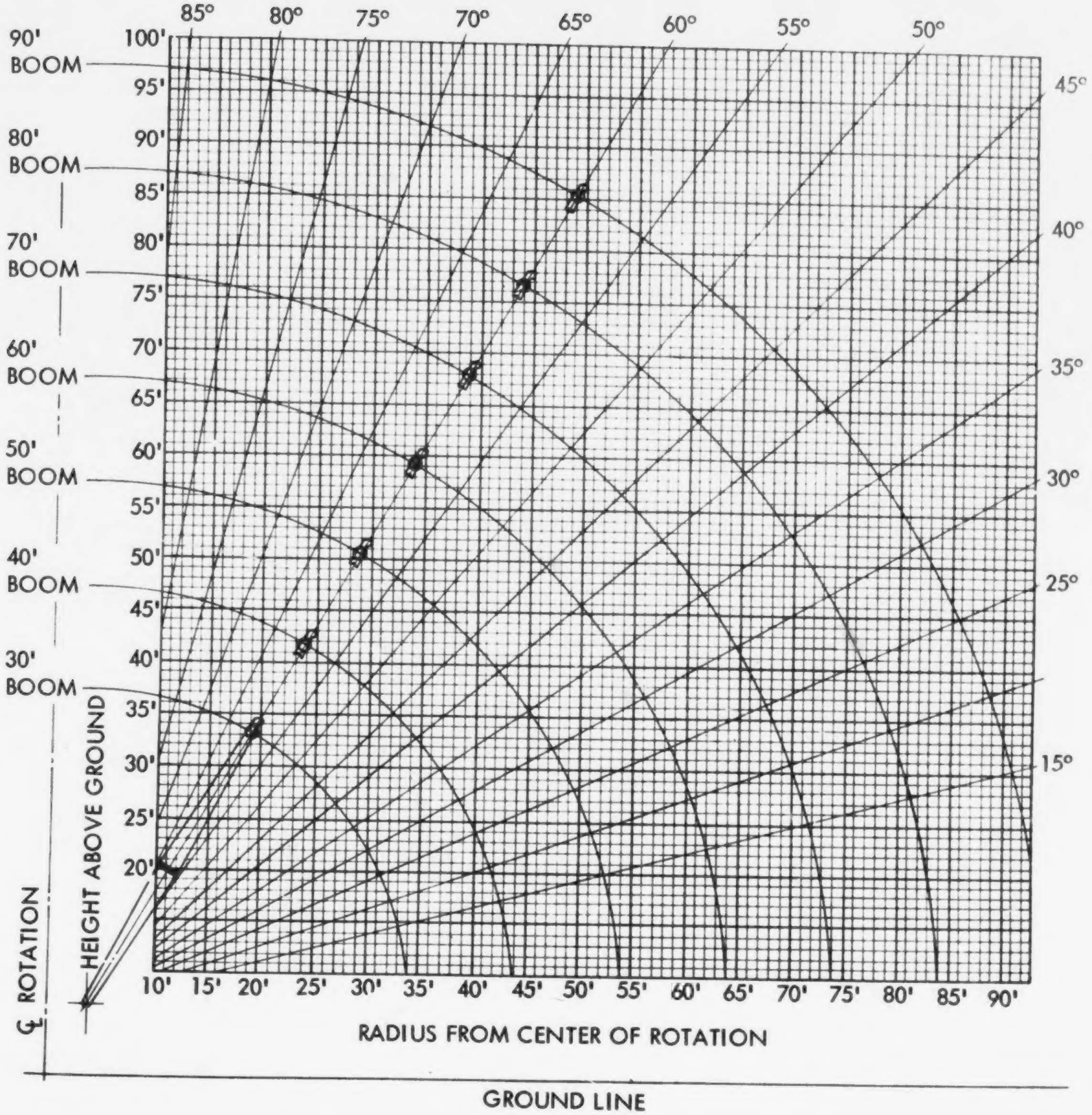
(18) *Carrier wiring diagram.* Refer to figure 1-9.

(19) *Hydraulic schematic.* Refer to figure 1-15.

1-5. Differences in Models

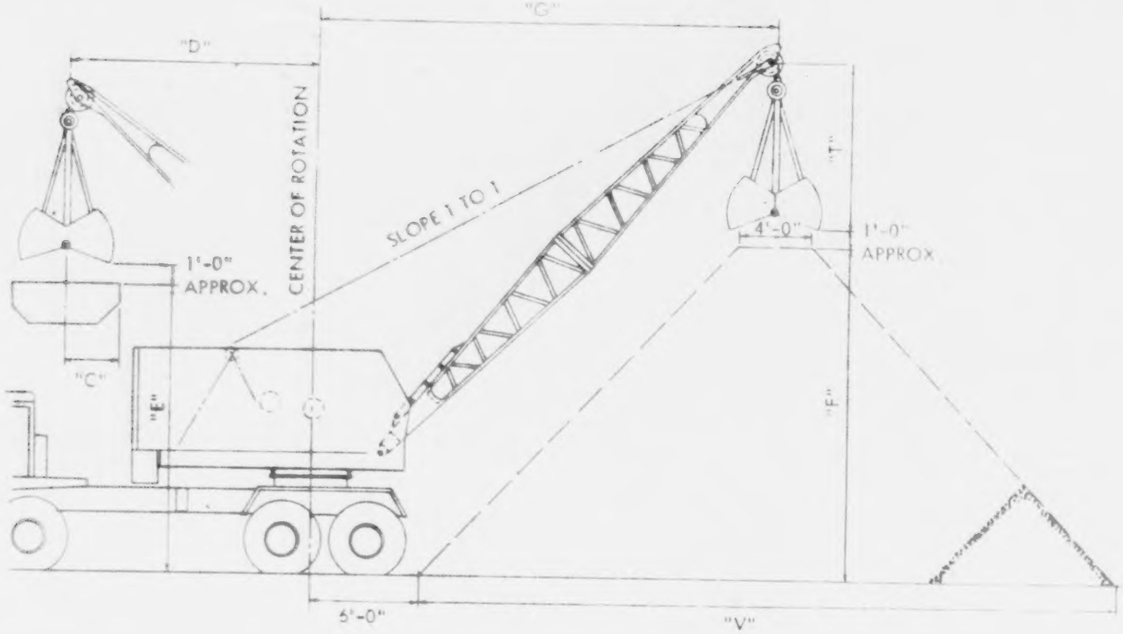
There are no differences in the Harnischfeger Model M320T truck crane in the serial number range E-31301 through E-31511 inclusive. The serial numbers listed below were furnished under a previous contract and are also identical machines.

E-29165 through 29260 inclusive
E-29446 through 29469 inclusive
E-29870
E-30020 through 30022
E-30032 through 30034 inclusive
E-30128 through 30225 inclusive
E-30237 through 30239 inclusive
E-30328 through 30331 inclusive



ME 3810-288-12/1-10

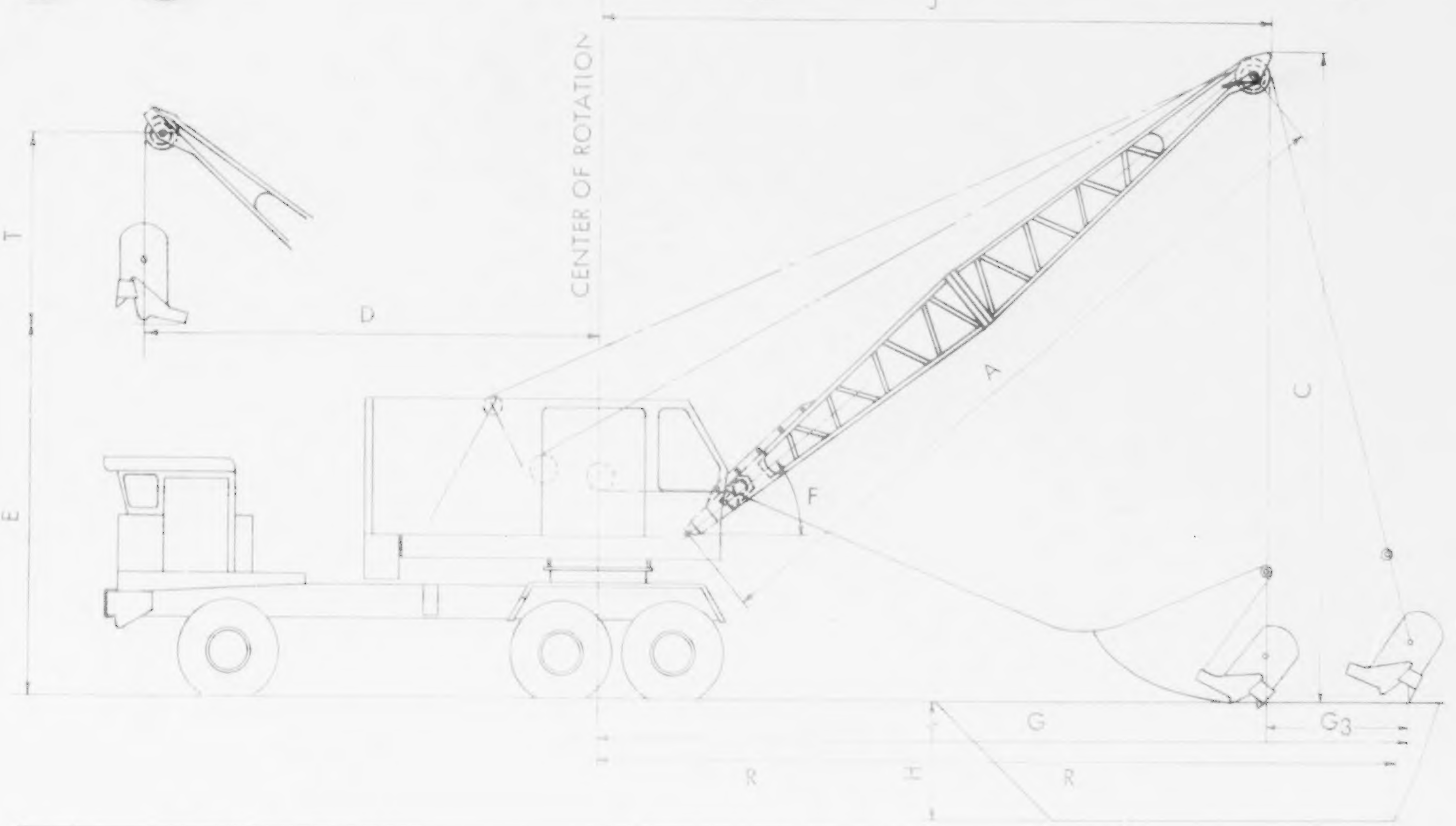
Figure 1-10. Crane range diagram.


"G"
"D"
CENTER OF ROTATION
SLOPE 1 TO 1
1'-0"
APPROX.
"C"
"E"
"T"
4'-0"
1'-0"
APPROX
"F"
5'-0"
"V"

CLAMSHELL WORKING RANGE	MODEL M320T			
OPERATING RADIUS	30 FT. BOOM		40 FT. BOOM	
"D"	HEIGHT & 1/2 WIDTH OF BIN		HEIGHT & 1/2 WIDTH OF BIN	
IN FEET	"E"	"U"	"E"	"U"
15	24'-6"	3'-4"		
20	21'-10"	5'-9"	31'-8"	3'-8"
25	17'-11"	9'-4"	29'-6"	5'-7"
30			26'-1"	8'-1"
HEIGHT AND WIDTH OF STOCK PILE	"F"	"V"	"F"	"V"
	17'-4"	39'-0"	24'-5"	53'-0"
OPERATING RADIUS "G"	25'-6"		32'-6"	
"T" (3/4 CU. YD. BUCKET)	9'-9"			

ME 3810-288-12/1-11

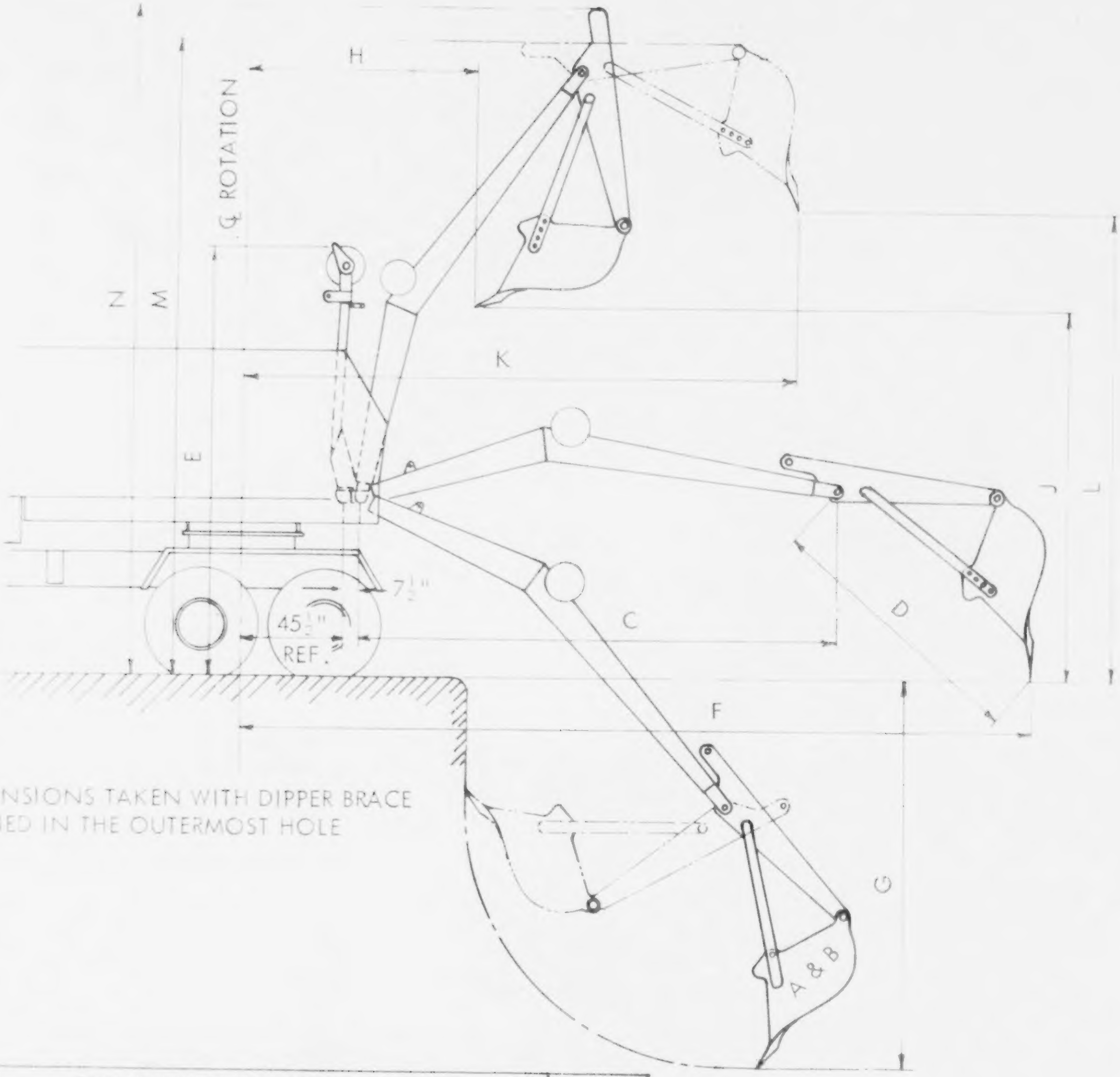
Figure 1-11. Clamshell range diagram.



	DRAGLINE WORKING RANGE	MODEL M32OT			
A	BOOM LENGTH	30 FT.		40 FT.	
F	BOOM ANGLE	25	40	25	40
D	DUMPING RADIUS	31'-9"	27'-6"	40'-9"	35'-1"
E	DUMPING HEIGHT (MAX.)	9'-3"	15'-10"	13'-6"	22'-3"
G	DIGGING REACH (APPROX.)	38'-9"	36'-9"	49'-2"	46'-5"
G_3	CASTING DISTANCE (APPROX.)	7'-0"	9'-3"	8'-5"	11'-4"
H	MAX. DIGGING DEPTH	17'-2"	14'-11"	23'-6"	23'-4"
C	CLEARANCE HEIGHT OF BOOM POINT	21'-0"	27'-9"	25'-3"	34'-1"
J	CLEARANCE RADIUS OF BOOM POINT	32'-6"	28'-2"	41'-7"	35'-10"
R	MAX. REACH @ MAX. DIGGING DEPTH	38'-9"	36'-9"	45'-1"	45'-3"
T	HEIGHT OF DRAGLINE BUCKET - 3/4 CU. YD.	10'-9"	10'-9"	10'-9"	10'-9"

ME 3810-288-12/1-12

Figure 1-12. Dragline range diagram.

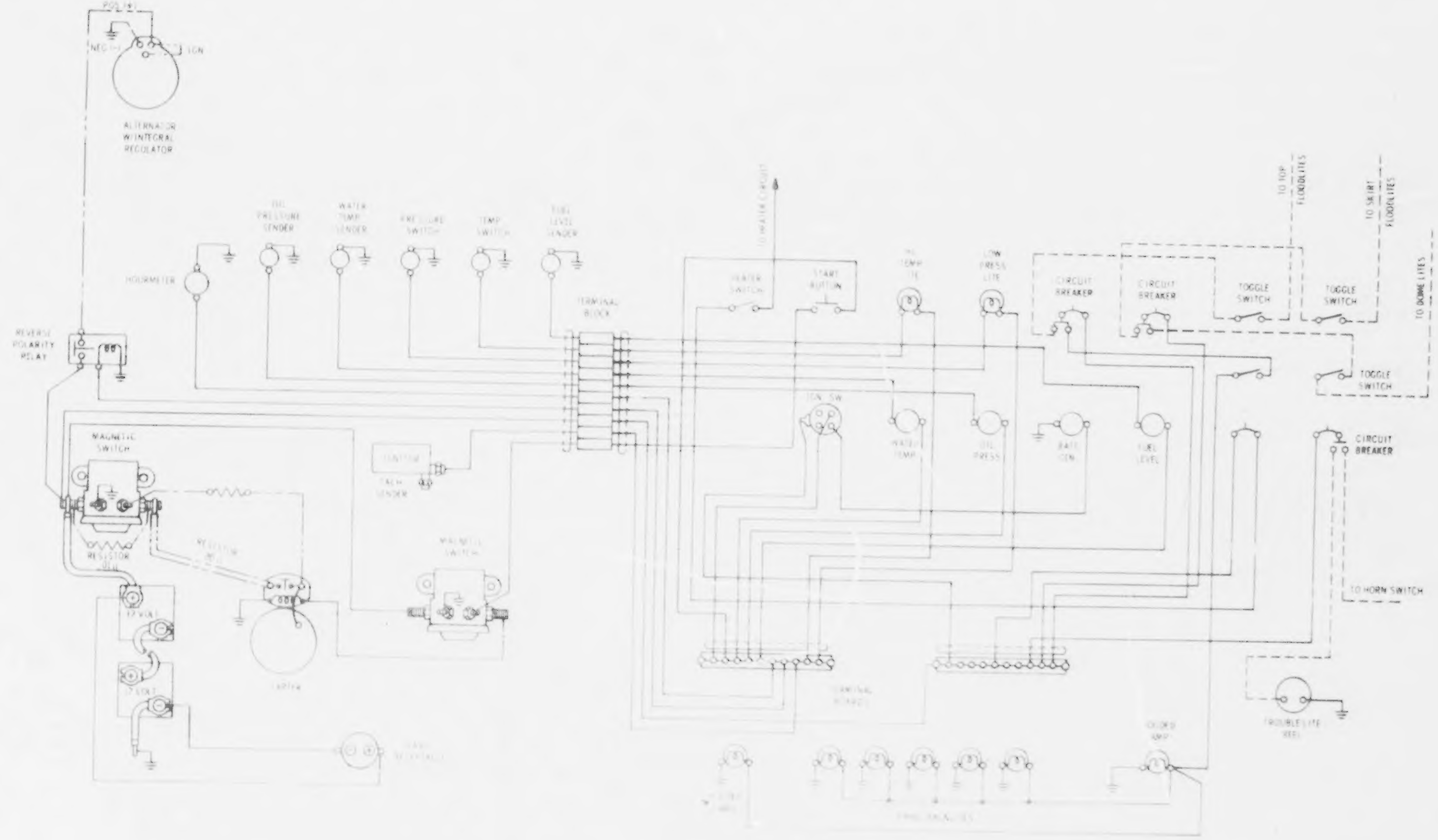


DIMENSIONS TAKEN WITH DIPPER BRACE PINNED IN THE OUTERMOST HOLE

	TRENCH HOE WORKING RANGE	
A	HOE DIPPER CAPACITY - CUBIC YARDS	3/4
B	HOE DIPPER WIDTH (OVER SIDE CUTTERS)	3'-3"
C	BOOM LENGTH	18'-0"
D	SWEEP RADIUS	10'-10"
E	HEIGHT OF HOE GANTRY	16'-5"
F	DIGGING REACH (AT GRADE LEVEL - MAX)	28'-10"
G	DIGGING DEPTH (MAXIMUM)	14'-6"
H	RADIUS AT BEGINNING OF DUMP	9'-5"
J	DUMPING HEIGHT AT BEGINNING OF DUMP	12'-10"
K	RADIUS AT END OF DUMP	20'-0"
L	DUMPING HEIGHT AT END OF DUMP	15'-6"
M	OVERALL HEIGHT AT END OF DUMP	24'-6"
N	OVERALL HEIGHT AT BEGINNING OF DUMP	25'-2"

ME 3810-288-12/1-13

Figure 1-13. Backhoe range diagram.


POS (+)
NEG (-)
IGN
ALTERNATOR W/INTEGRAL REGULATOR
REVERSE POLARITY RELAY
HOURMETER
OIL PRESSURE SENDER
WATER TEMP SENDER
PRESSURE SWITCH
TEMP SWITCH
FUEL LEVEL SENDER
TERMINAL BLOCK
MAGNETIC SWITCH
RESISTOR (OIL)
RESISTOR (OIL)
12 VOLT
12 VOLT
STARTER
IGNITION
TACH SENDER
MAGNETIC SWITCH
SLAVE RECEPTACLE
TO HEATER CIRCUIT
HEATER SWITCH
START BUTTON
OIL TEMP LITE
LOW PRESS LITE
CIRCUIT BREAKER
CIRCUIT BREAKER
TOGGLE SWITCH
TOGGLE SWITCH
TO TOP FLOODLITES
TO SKIRT FLOODLITES
TO DOME LITES
IGN SW
WATER TEMP
OIL PRESS
BATT GEN
FUEL LEVEL
TOGGLE SWITCH
CIRCUIT BREAKER
TO HORN SWITCH
TERMINAL BOARDS
TROUBLE LITE REEL
PANEL GAUGES

(CAB PANEL SHOWN FROM REAR SIDE)

ME 3810-288-12/1-14

Figure 1-12. Crane wiring diagram

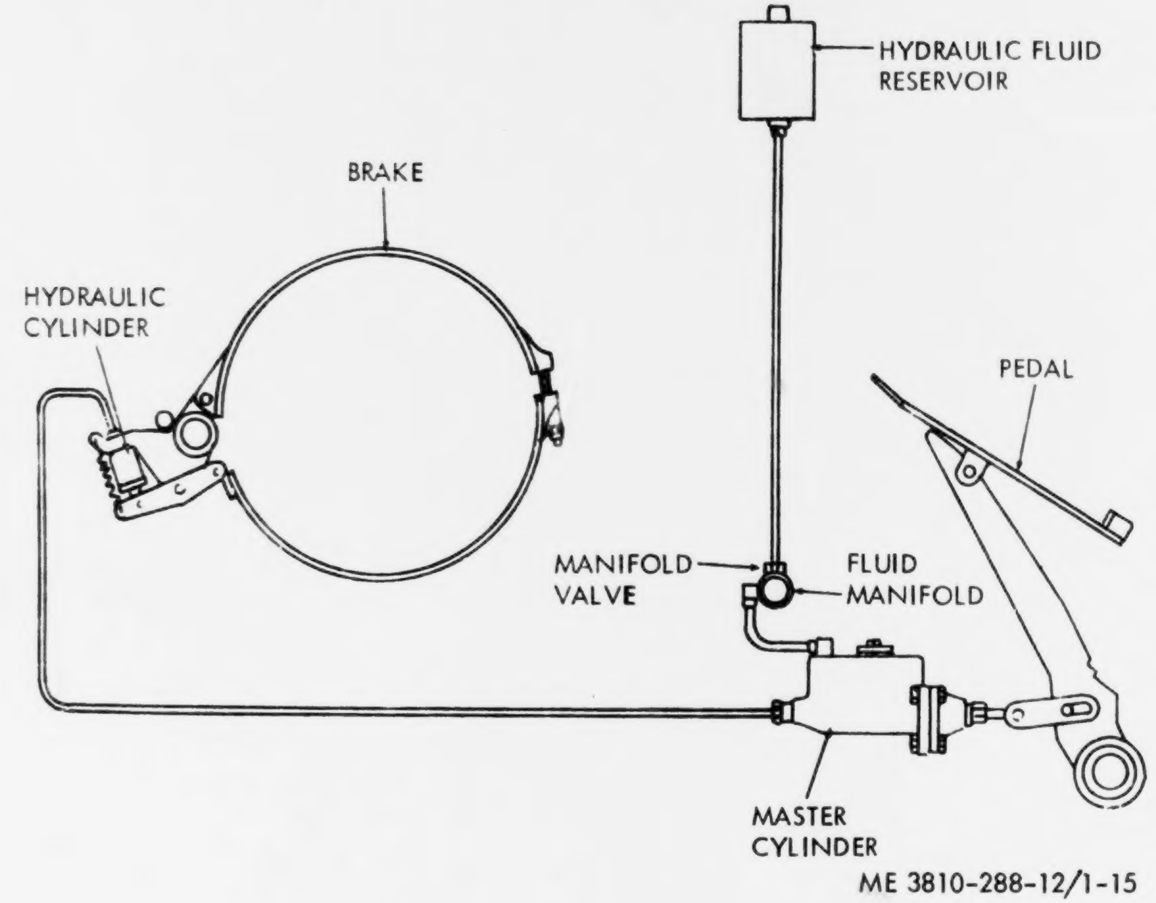

HYDRAULIC FLUID RESERVOIR
BRAKE
HYDRAULIC CYLINDER
PEDAL
MANIFOLD VALVE
FLUID MANIFOLD
MASTER CYLINDER
ME 3810-288-12/1-15

Figure 1-15. Hydraulic schematic.

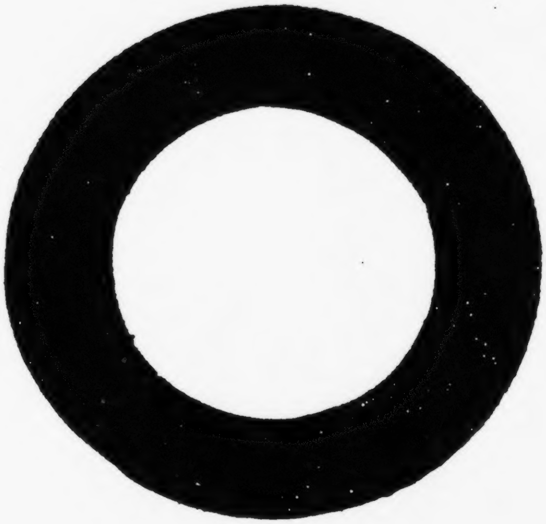
Table 1-1. Cable Specifications

	BOOM LENGTH	CABLE		CABLE LENGTH												
		TYPE	DIA. (In.)	SHOVEL	TRENCH HOE	DRAG LINE	CLAM SHELL	PILE DRIVER	CRANE							
									1 PART	2 PART	3 PART	4 PART				
BOOM HOIST	18'-6"	†	1/2	245'-0" (Crane 10 Part, Shovel 8 Part & Hoe 4 Part)												
	19'-0"	†	1/2													
	30'-90"	†	1/2													
HOIST #	18'-6"	†	3/4		95'-0"											
	30'-0"	†	5/8						100'-0"	150'-0"	200'-0"	250'-0"				
	40'-0"	†	5/8						120'-0"	180'-0"	240'-0"	300'-0"				
	50'-0"	†	5/8						140'-0"	210'-0"	280'-0"	350'-0"				
	60'-0"	†	5/8						160'-0"	240'-0"	320'-0"	400'-0"				
	70'-0"	†	5/8						180'-0"	270'-0"	360'-0"	450'-0"				
	80'-0"	†	5/8						200'-0"	300'-0"	400'-0"					
	90'-0"	†	5/8						220'-0"	330'-0"	440'-0"					
	30'-0"	†	5/8			70'-0"										
	40'-0"	†	5/8			90'-0"										
DIGGING	18'-6"	†	3/4		65'-0"											
	30'-0"	†	3/4			57'-6"										
	40'-0"	†	3/4			57'-6"										
CLOSING #	30'-0"	†	5/8				85'-0"									
	40'-0"	†	5/8				105'-0"									
HOLDING #	30'-0"	†	5/8				70'-0"									
	40'-0"	†	5/8				90'-0"									
TAGLINE	30'-0"	†	3/8				60'-0"									
	40'-0"	†	3/8				60'-0"									
									15' JIB		20' JIB		25' JIB		30' JIB	
									1 PART	2 PART	1 PART	2 PART	1 PART	2 PART	1 PART	2 PART
JIB HOIST #	30'-0"	†	5/8						110'-0"	160'-0"	120'-0"	175'-0"	130'-0"	190'-0"	140'-0"	205'-0"
	40'-0"	†	5/8						130'-0"	190'-0"	140'-0"	205'-0"	150'-0"	220'-0"	160'-0"	235'-0"
	50'-0"	†	5/8						150'-0"	220'-0"	160'-0"	235'-0"	270'-0"	250'-0"	180'-0"	265'-0"
	60'-0"	†	5/8						170'-0"	250'-0"	180'-0"	265'-0"	190'-0"	280'-0"	200'-0"	295'-0"
	70'-0"	†	5/8						190'-0"	280'-0"	200'-0"	295'-0"	210'-0"	310'-0"	220'-0"	325'-0"
	80'-0"	†	5/8						210'-0"	310'-0"	220'-0"	325'-0"	230'-0"	340'-0"	240'-0"	355'-0"
	90'-0"	†	5/8						230'-0"	340'-0"	240'-0"	355'-0"	250'-0"	370'-0"	260'-0"	385'-0"
GUY LINE JIB TO STRUT																
GUY LINE STRUT TO MAIN BOOM	30'-0"								35'-0"		45'-0"		55'-0"		65'-0"	
	40'-0"								68'-0"		68'-0"		68'-0"		68'-0"	
	50'-0"								88'-0"		88'-0"		88'-0"		88'-0"	
	60'-0"								108'-0"		108'-0"		108'-0"		108'-0"	
	70'-0"								128'-0"		128'-0"		128'-0"		128'-0"	
	80'-0"								148'-0"		148'-0"		148'-0"		148'-0"	
	90'-0"								168'-0"		168'-0"		168'-0"		168'-0"	
									188'-0"		188'-0"		188'-0"		188'-0"	
HAMMER HOIST #	30'-0"		5/8					75'-0"								
	40'-0"		5/8					95'-0"								
PILE HOIST #	30'-0"		5/8					90'-0"								
	40'-0"		5/8					110'-0"								
SHOVEL HOIST	19'-0"	†	5/8	105'-0"												
SHOVEL CROWD	19'-0"	†	3/4	57'-6"												
SHOVEL RETRACT	19'-0"	†	3/4	26'-0"												

NOTE:

1. † MIL SPEC RR-W-410, TYPE 1, CLASS 2, 6 x 19, CONSTRUCTION 3, IWRC, IPS, UNCOATED, PREFORMED, RIGHT REGULAR LAY

2. # HOIST LENGTHS PER MIL-C-10466D PAR. 3.17.33.2



CHAPTER 2

INSTALLATION AND OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment

a. General. The operators of the carrier and crane may assist in unloading the equipment. The operators will help in the removal of the tie-down cables, strapping, and blocking which secures the equipment. The operator will drive the carrier down the ramp when hoisting equipment is not available.

b. Inspecting the Equipment.

(1) Refer to figure 2-1 and remove all materials used to protect the crane and carrier during shipment.

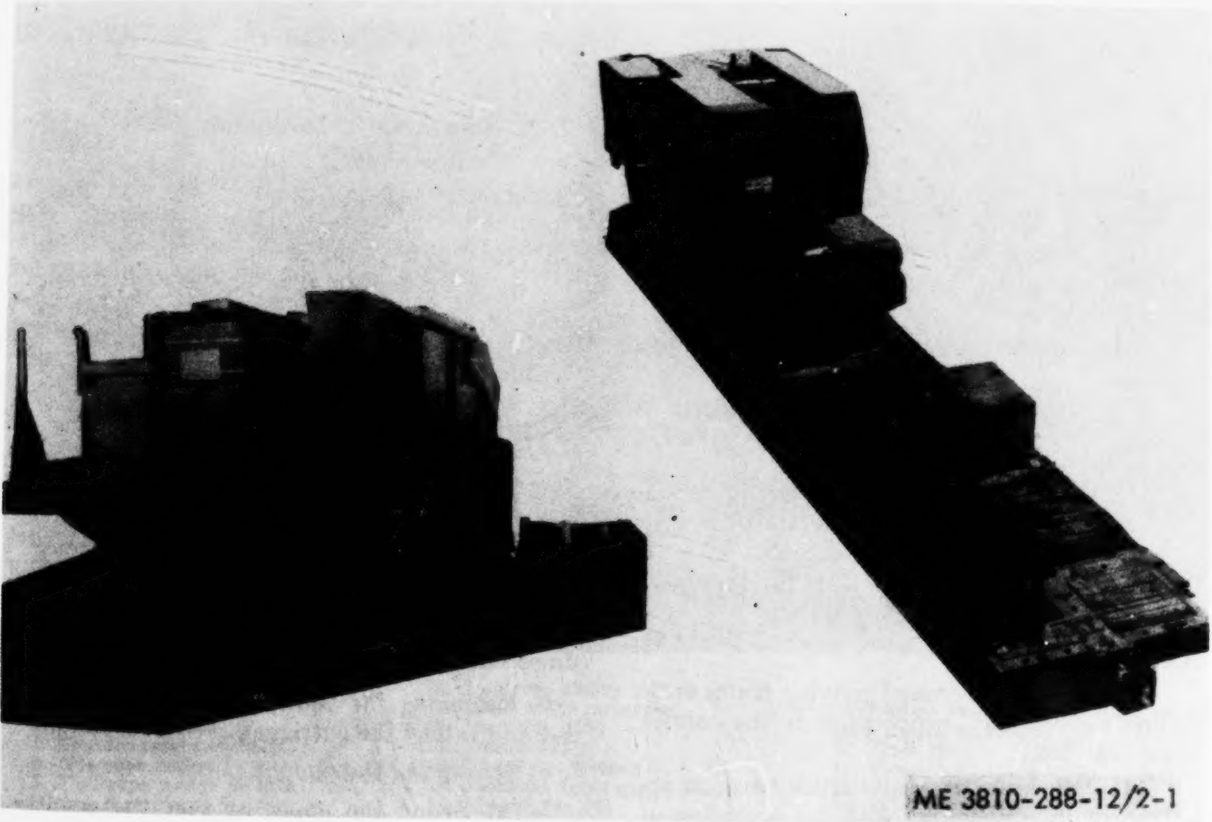
(2) Remove protective wrappings from the operator's seats, headlights, taillights, floodlights, and the faces of instruments.

(3) Make a complete visual inspection of the crane and carrier to see that the required publications, tools, accessories, attachments, and repair parts are with the crane and carrier.

(4) Inspect the entire crane and carrier for missing parts or damage which may have occurred during loading, shipment, or unloading. Inspect the crane and carrier engines, tires, revolving frame machinery, giass panels, and instruments for damage.

(5) Inspect all separately packed equipment for damage.

(6) Report all damage and all missing parts to organizational maintenance.



ME 3810-288-12/2-1

Figure 2-1. Materials used for shipping protection.

c. Servicing the Equipment.

Note. Make certain that the crane and carrier have been deprocessed completely before servicing.

(1) Make certain that the engine cooling systems are full. See TB ORD 651 for proper antifreeze solutions.

(2) Drain the engine crankcases and oil filters, and refill to the operating level with oil of the type specified in the current Lubrication Order.

(3) Remove all tape, and wrappings from the engine crankcase breathers, intake and exhaust openings, crane engine torque converter breather, alternator, and clutches and brakes.

(4) Check the tension on the fan and alternator drive belts, and adjust if necessary as described in paragraphs 3–49 and 7–41.

(5) Fill the crane and carrier fuel tanks with gasoline.

(6) Remove the protective material and blocking from the clutches in the crane machinery.

(7) Check the level of the lubricant in the crane gear and chain housing, and add lubricant of the type specified in the LO if necessary. Lubricate the reversing shaft drive chain.

(8) Remove the tape or plugs from the air brake system safety valve and relay emergency valves. Close the reservoir drain cocks.

(9) Make certain that the hydraulic system reservoirs on the crane and carrier are filled with hydraulic fluid to the proper level.

(10) Remove wrappings from all machined surfaces, and clean the surfaces to remove preservative coatings.

(11) Deflate the tires to normal operating pressure.

Note. If the lubrication order specifies OE 10 for operation, the preservative oil may be used until the first required oil change.

(12) Remove the seals from the crane and carrier battery filler caps. Remove battery material and clean preservative coating from the terminals. Fill the batteries with the separately packed electrolyte; check the specific gravity of the electrolyte, using a hydrometer. Connect the battery cables.

(13) Detach the crane revolving frame anti-rotation devices, and secure them to the carrier frame (fig. 2–2).

(14) Lubricate the entire truck crane in accordance with current LO with the exception of the special instructions in this section.

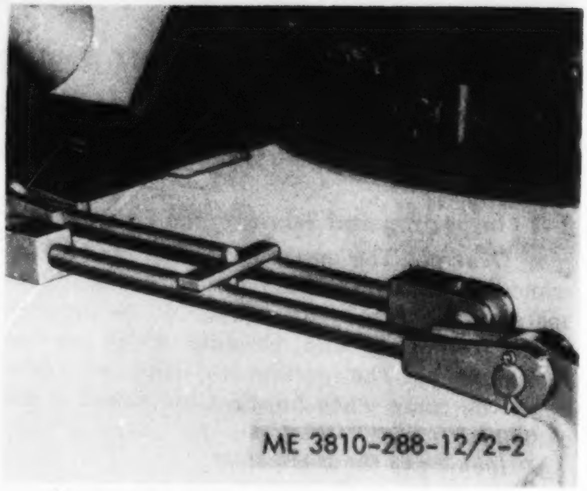


Figure 2–2. Anti-rotation device, stored position.

(15) Inspect the complete truck crane and components to ensure that all protective devices and compounds have been removed, and that all lubricant levels are correct, before operating the equipment. Make a complete inspection of the machine, looking for leaks, loose electrical connections or fittings, and any other unsafe condition.

2–2. Installation of Separately Packed Components

Boom components are separately packed. Refer to paragraph 2–4 for installation instructions. Components packed in the box on the flatcar are illustrated in figure 2–3. The use or installation of each of the items in figure 2–3 is covered under the installation procedure for the attachment with which the item is used.

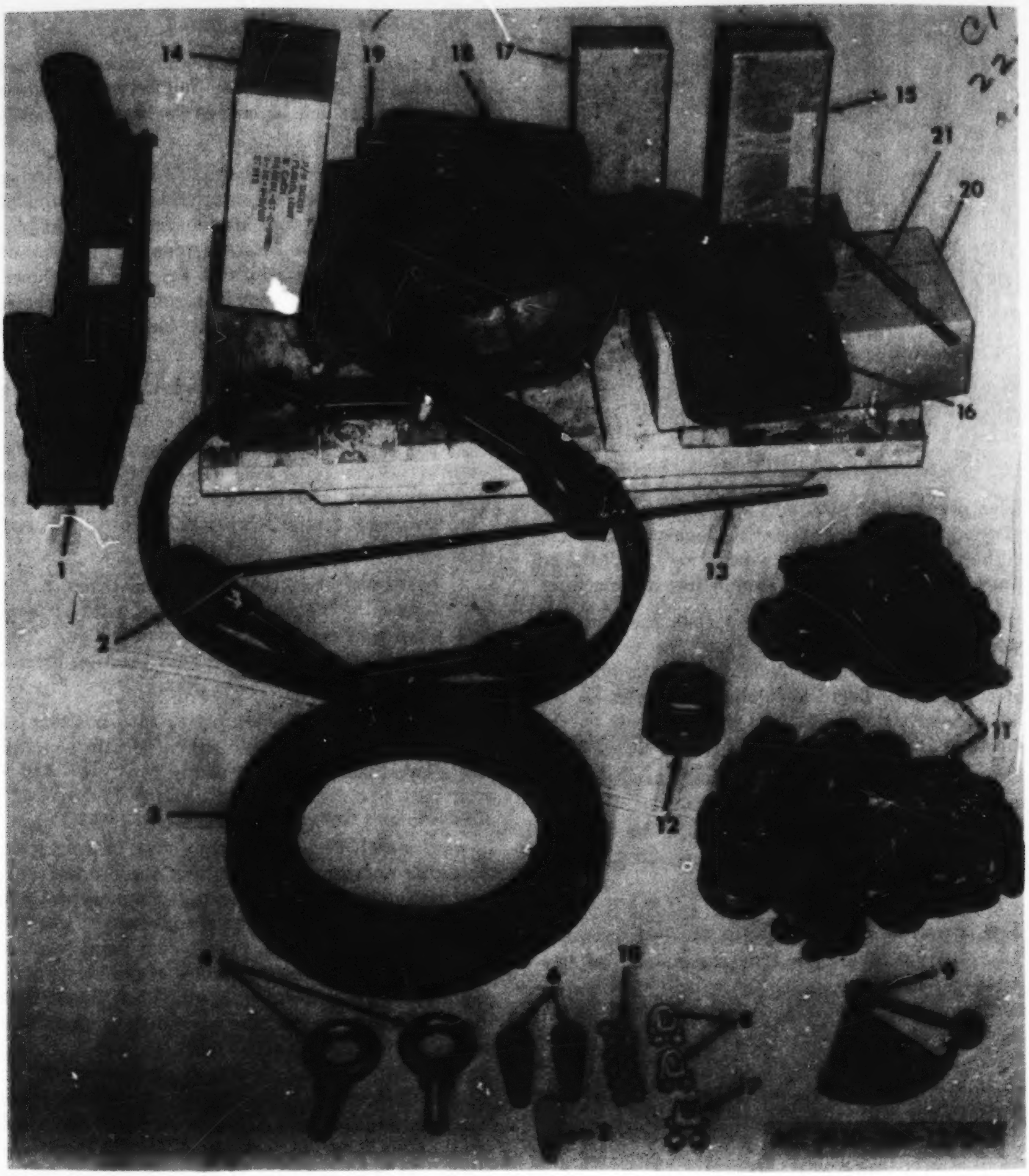
2–3. Installation or Setting Up Instructions

a. General. Set up the equipment in a location where the carrier will be level. Uneven terrain may have to be leveled. Outriggers are provided to improve machine stability; the outriggers must be extended and set as specified on the rating plate in the crane operator's cab. The jackscrews must be kept tight against the jackfloats at all times during operation.

b. Extending the Outriggers. Refer to figure 2–4 and extend the outriggers.

c. Setting the Outriggers.

(1) Swing the upper so that the counterweight is over the left side of the carrier, to re-



C1
22

1. Upper spreader
2. Guy cables (2)
3. Boom hoist cable
4. Counterweight eyebolts
5. One rope wedge ½ inch
6. Two rope wedge ⅝ inch
7. One rope clamp ⅝ inch
8. Two rope clamp ½ inch
9. Boom angle indicator
10. Jam nuts (12)
11. Chains (2)
12. Wheel nut wrench
13. Jackfloat (outrigger) handle
14. Floodlights (6)
15. Fire extinguisher
16. Canvas case with operators manual
17. Fire extinguisher
18. Hook block
19. Crane connection wire
20. Rear view mirror (2)
21. Windshield wiper

Figure 2–3. Separately packaged components.

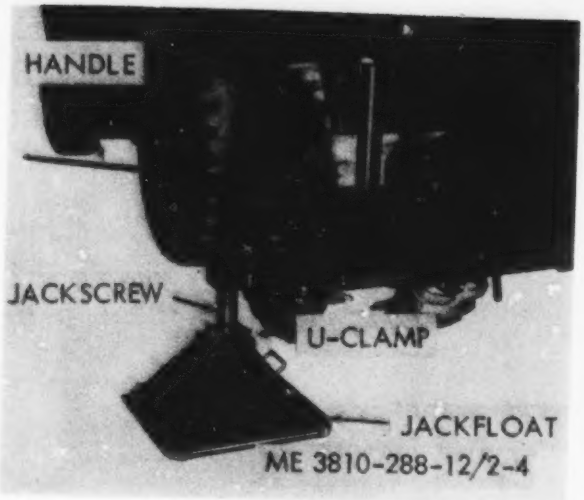


Figure 2-4. Extending outriggers.

lieve pressure on the jackfloats on the right side of the carrier. Turn down the jackscrews on the right side of the carrier until the jackfloats on the right side are firmly supporting the machine.

(2) Swing the upper so that the counterweight is over the right side of the carrier, to relieve pressure on the jackfloats on the left side of the carrier. Turn down the jackscrews on the left side of the carrier until the jackfloats on the left side are firmly supporting the machine.

(3) Outrigger positioning and operation. Put outrigger down just far enough to take strain off the tires and machine is level within one degree.

d. Retracting the Outriggers. Refer to figure 2-5 and retract the outriggers.

2-4. Equipment Conversion

a. General. The basic truck crane can be converted to various uses by changing front-end attachments. The converted truck crane may be referred to as a crane, clamshell, dragline, piledriver, backhoe, or shovel. The various conversions are described in paragraphs 2-5 through 2-10. When a conversion is anticipated, make certain that all required attachments, tools, blocking, personnel, and a suitable lifting device are available.

Note. Before reeving any line, lay out the line so that there is no possibility of kinking during the reeving process. Refer to paragraph 3-31 for information on the handling and maintenance of wire rope. When wrapping new cable on a drum, wrap the cable slowly and make certain that the cable wraps evenly on the drum the first time.

b. Counterweight Installation.

Caution: **Proceed slowly and carefully when removing or installing the counterweight, since severe damage can be caused by improper handling.**

(1) Install two eyebolts and a suitable lifting sling in the tapped holes provided in the top of the counterweight, and lift the counterweight into position on the two locating pins on the deck of the carrier. The locations of the pins are shown in figure 2-6. Use the crane boom and main hoist line to lift the counterweight (sec. III, Controls and Instruments).

(2) Remove the eyebolts and stow them in the tool box.

(3) Swing the revolving frame so that the rear of the revolving frame is positioned over the counterweight, and the two holes in the rear of the revolving frame are directly above the two tapped holes in the counterweight.

(4) Insert the two long bolts through the guide tubes in the revolving frame, with spacers and plain washers located as shown in figure 2-6, and raise the counterweight into position gradually by tightening the bolts evenly.

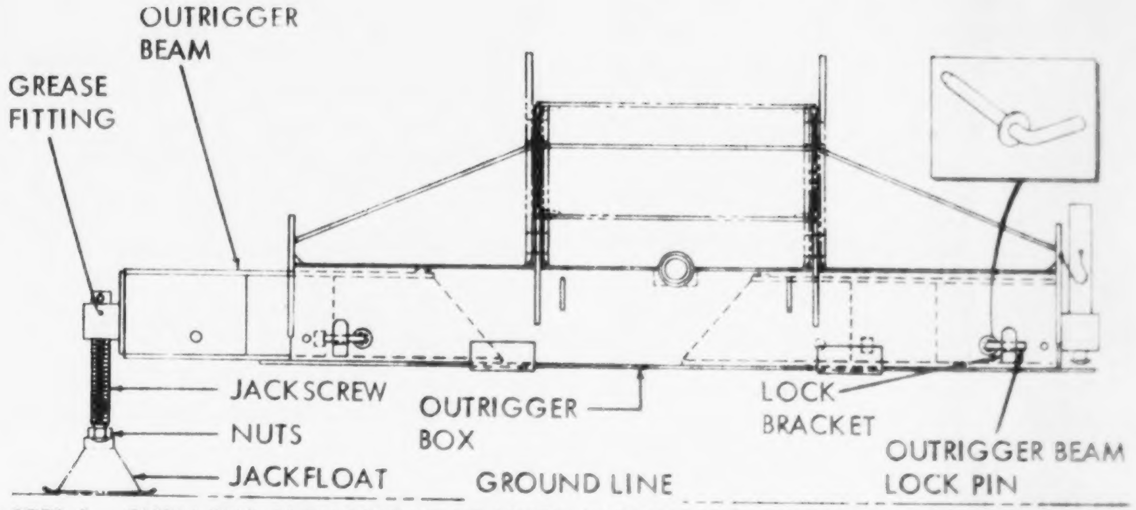
(5) Bolt the keeper plates into position as shown in figure 2-6, and make certain that all bolts have been tightened firmly.

2-5. Crane Conversion

a. General. The truck crane may be converted to crane operation by installing the crane front-end assembly. The following components are necessary for the equipment conversion; one 15-foot boom base section, one 15-foot point section, boom foot pins, boom guy cables, boom hoist cable, boom backstops, hoist line, and hook block. The basic crane boom may be extended by installing boom inserts between the boom base section and the boom point section. The boom inserts are in 10-foot lengths, and must be for the specific boom installed so that the connecting joints of the boom and insert match. Longer guy cables are necessary when the length of the boom is increased; refer to paragraph 1-4 for the required cables.

b. Boom Installation.

Note. To install the boom, a cribbing will be necessary to support the boom in a horizontal position. The cribbing must be high enough to bring the boom into position with the boom foot lugs on the revolving frame, as shown in figure 2-7.



STEP 1. TURN THE JACKSCREWS UP UNTIL WEIGHT OF MACHINE IS SUPPORTED ON CARRIER TIRES. REFER TO FIGURE 2-4.

STEP 2. REMOVE THE U-CLAMP PINS, AND REMOVE THE JACKFLOATS FROM THE JACKSCREWS. STORE THE JACKFLOATS WITH THE U-CLAMP PINS IN THE WELLS OF THE CARRIER DECK.

STEP 3. REMOVE THE LOCK PINS FROM THE OUTRIGGER BOXES.

STEP 4. PUSH THE OUTRIGGER BEAMS BACK INTO THE OUTRIGGER BOXES, AND RE-PIN THE BEAMS BACK INTO THE RETRACTED POSITION.

CAUTION: THE OUTRIGGERS MUST BE PINNED IN THE RETRACTED POSITION WHEN TRAVELING THE CARRIER.

ME 3810-288-12/2-5

Figure 2-5. Retracting the outriggers.

(1) Lift the boom sections into place on the cribbing.

(2) Refer to figure 2-8 and install the boom connection capscrews, lockwashers and locknuts so that the boom base section, insert (if used), and tip section form a complete assembly.

(3) Carefully move the carrier up to the cribbed up boom, so that the bores in the boom foot lugs on the revolving frame are aligned with the bores in the boom base section.

(4) Refer to figure 2-9 and install the boom foot pins.

(5) Install the boom backstops between the gantry and boom, as shown in figure 2-10.

c. Crane Boom Angle Indicator Installation. Refer to figure 2-11 and install the boom angle indicator.

d. Boom Hoist Cable Reeving.

(1) Use a suitable lifting device, and lift the upper spreader into position on the boom. Install the two guy cables (fig. 2-12). Secure one end of each cable to the boom point and the other end to the upper spreader with pins. Secure the pins with cotter pins.

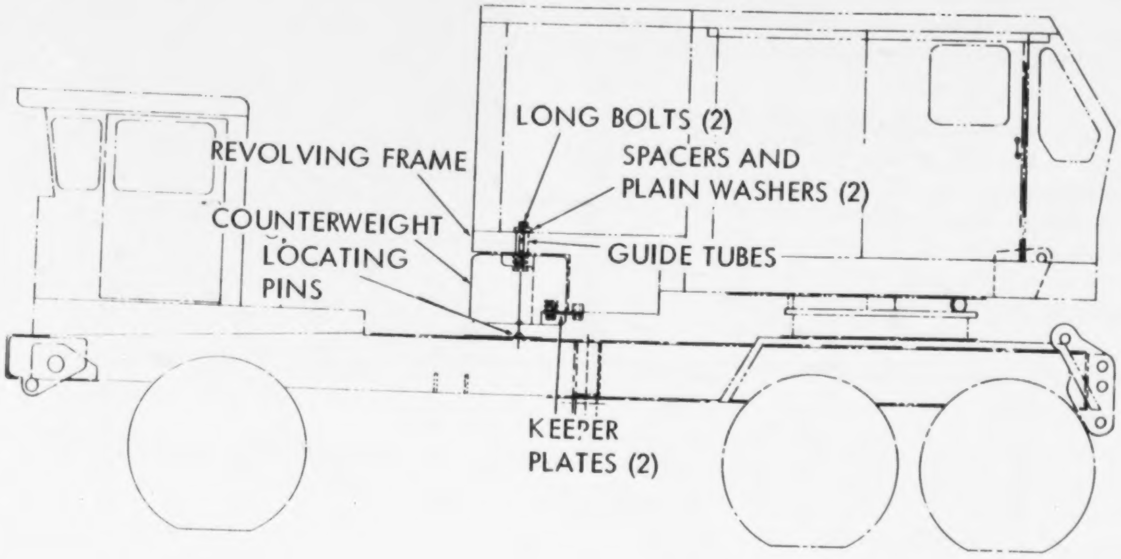

LONG BOLTS (2)
REVOLVING FRAME
SPACERS AND PLAIN WASHERS (2)
COUNTERWEIGHT
LOCATING PINS
GUIDE TUBES
KEEPER PLATES (2)
ME 3810-288-12/2-6

Figure 2-6. Counterweight installation.

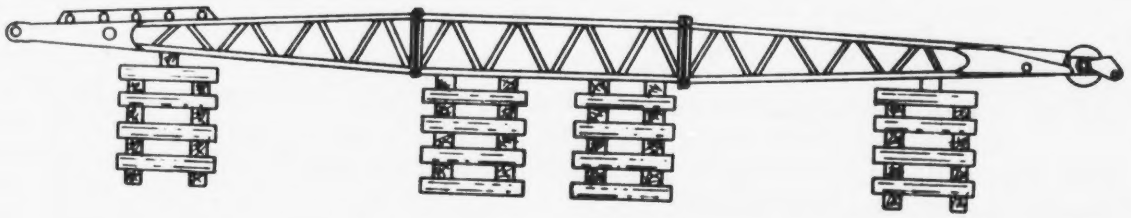

ME 3810-288-12/2-7

Figure 2-7. Cribbing prepared for boom assembly and installation.

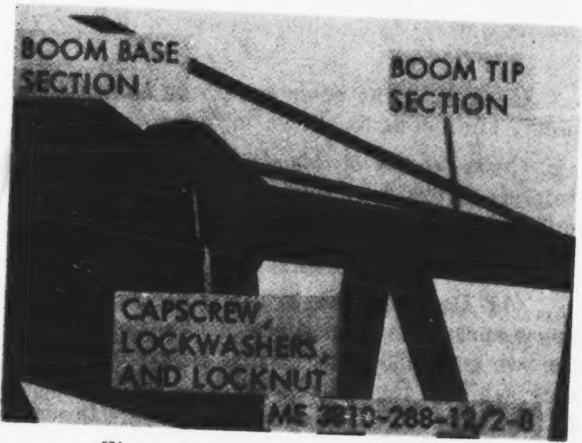

BOOM BASE SECTION
BOOM TIP SECTION
CAPSCREW, LOCKWASHERS, AND LOCKNUT
ME 3810-288-12/2-8

Figure 2-8. Connecting boom sections.

(2) Install the gantry spreader on the gantry A-frame.

(3) Unroll and stretch the boom suspension cable out on the ground on the right side of the boom.

(4) Reeve one end of the cable from the center upper spreader sheave left side, around the lower left gantry spreader sheave, around the lower left upper spreader sheave, around the upper left gantry spreader sheave, around the upper left upper spreader sheave, around the left gantry peak pin sheave, and to the dead-end socket on the gantry A-frame (fig. 2-13).

(5) Reeve the other end of the cable around the center upper spreader sheave, around the

STEP 1. INSTALL BOOM FOOT PINS.
STEP 2. INSTALL LOCKPLATES IN PIN SLOTS.
STEP 3. INSTALL CAPSCREWS AND LOCKWASHERS.

BOOM
BOOM FOOT PINS (2)
CAPSCREW (4) AND LOCKWASHER (4)
ME 3810-288-12/2-9

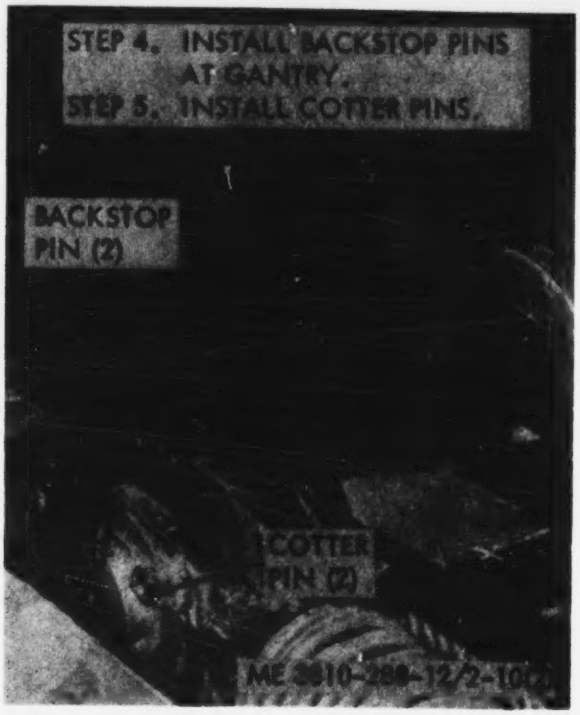
Figure 2-9. Installing boom foot pins.

BOOM BACKSTOP
BACKSTOP PINS (2)
COTTER PINS (2)

Figure 2-10. Boom backstop installation. (Sheet 1 of 2)

lower right gantry spreader sheave, around the upper right upper spreader sheave, around the upper right gantry spreader sheave, around the lower right upper spreader sheave, around the right gantry peak pin sheave, and down to the boom hoist drum.

(6) Secure the boom hoist line to the boom hoist drum as shown in figure 2-14, and spool the slack cable on the drum.



STEP 4. INSTALL BACKSTOP PINS AT GANTRY.
STEP 5. INSTALL COTTER PINS.

Figure 2-10. Boom backstop installation. (Sheet 2 of 2)

e. Main Hoist Line Reeving.

(1) Main hoist line reeving is shown in figure 2-15. The number of parts of line (from one to five) used on the main hoist line depends on the weight of the loads to be lifted and the line speed desired. For maximum speed of operation, use no more parts of line than are required for the loads to be lifted, within the limitations shown on the rating plate in the machine upper cab.

(2) Reeve the main hoist line on the rear main drum, and reeve the secondary hoist line (if used) on the front main drum. If a jib is used, reeve the jib line on the rear main drum, and the main hoist line on the front main drum. Secure the hoist lines to the drums as shown in figure 2-14.

(3) A single-part line is reeved over the center boom point sheave, directly to a weighted hook, and is deadended at the hook. A weighted hook must be used for single line operation, instead of a hook block.

(4) A two-part line is reeved over the center boom point sheave, around one hook block sheave, and deadended at the boom point.

(5) A three-part line is reeved over the left boom point sheave, around a hook block sheave,

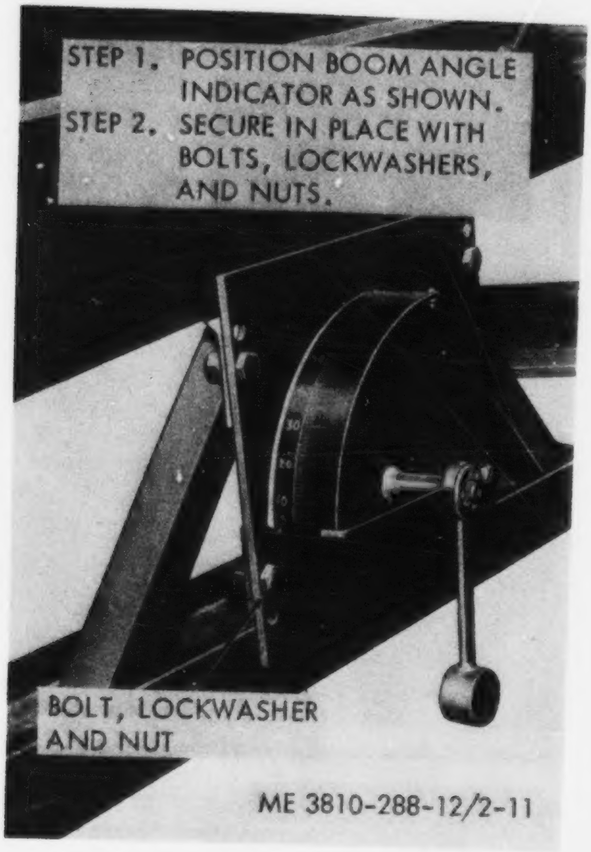

STEP 1. POSITION BOOM ANGLE INDICATOR AS SHOWN.
STEP 2. SECURE IN PLACE WITH BOLTS, LOCKWASHERS, AND NUTS.
BOLT, LOCKWASHER AND NUT
ME 3810-288-12/2-11

Figure 2-11. Crane boom angle indicator installation.

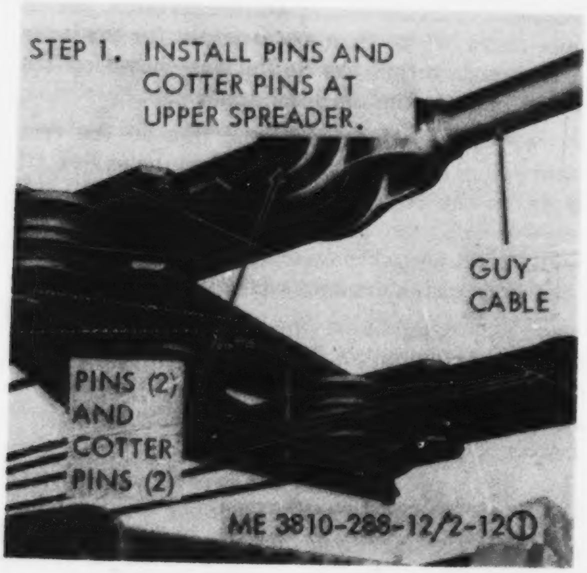

STEP 1. INSTALL PINS AND COTTER PINS AT UPPER SPREADER.
GUY CABLE
PINS (2) AND COTTER PINS (2)
ME 3810-288-12/2-12①

Figure 2-12. Guy cables, removal and installation. (Sheet 1 of 2)

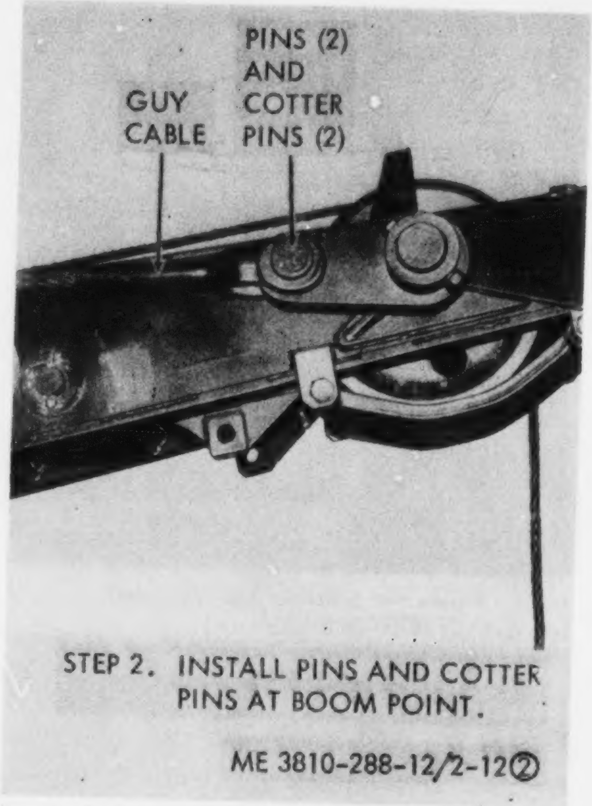

GUY CABLE
PINS (2) AND COTTER PINS (2)
STEP 2. INSTALL PINS AND COTTER PINS AT BOOM POINT.
ME 3810-288-12/2-12②

Figure 2-12. Guy cables, removal and installation. (Sheet 2 of 2)

around the right boom point sheave, and deadended at the hook block.

(6) A four-part line is reeved over the left boom point sheave, around the left hook block sheave, around the right boom point sheave, around the right hook block sheave, and deadended at the boom point.

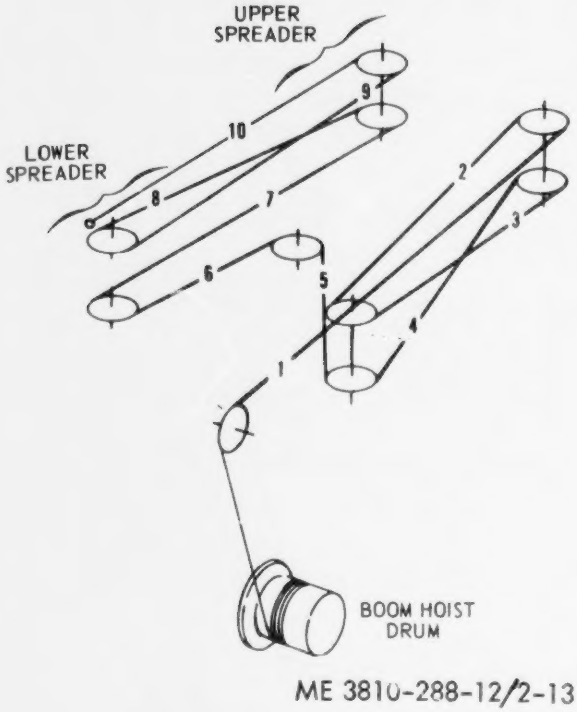
(7) A five-par line is reeved over the left boom point sheave, around the left hook block sheave, around the center boom point sheave, around the right hook block sheave, around the right boom point sheave, and deadended at the hook block.

f. Unreeving the Hoist Line.

(1) Lower the hook block to the ground. Lower the boom until the boom point is approximately five feet from the ground.

(2) Remove the cable from the deadend socket on the boom point or hook block.

(3) Unreeve the cable from the hook block and boom point sheaves.



Figuure 2–13. Boom hoist line reeving.

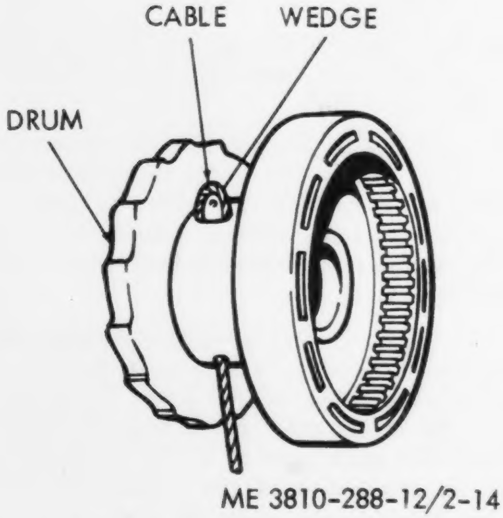


Figure 2–14. Securing cable to drum.

(4) Release the drum brake, and pull the cable from the drum. Remove the cable wedge from the cable drum socket and free the cable.

(5) Pull the cable free of the cable drum and the boom point sheave, and lay it out straight on the ground.

(6) Roll the cable into a coil and secure it with wire. Label the cable for future use.

g. Unreeving the Boom Hoist Cable.

(1) Swing the revolving frame so that the boom is over the rear of the carrier. Lower the boom to a horizontal position, level with the carrier.

(2) Build up cribbing under the boom as shown in figure 2–7.

(3) Lower the boom to rest on the cribbing, and continue to slack off on the boom hoist cable until the upper spreader comes to rest on the boom.

(4) Unspool the boom hoist cable from the drum. Remove the wedge from the cable drum socket, and free the cable.

(5) Disconnect the cable deadend at the gantry and free the cable. Refer to figure 2–13.

(6) Unreeve the boom hoist cable from the gantry spreader and upper spreader sheaves.

(7) Lay the cable out straight on the ground.

(8) Roll the cable into a coil and secure it with wire. Label the cable for future use.

(9) Remove the guy cables by removing the cotter pins and pins from both ends of the cables. Refer to figure 2–12.

(10) Using a suitable lifting device, lift the upper spreader from the crane boom.

h. Removing the Crane Boom.

(1) Unreeve the hoist line and boom hoist line. Support the boom on cribbing as shown in figure 2–7.

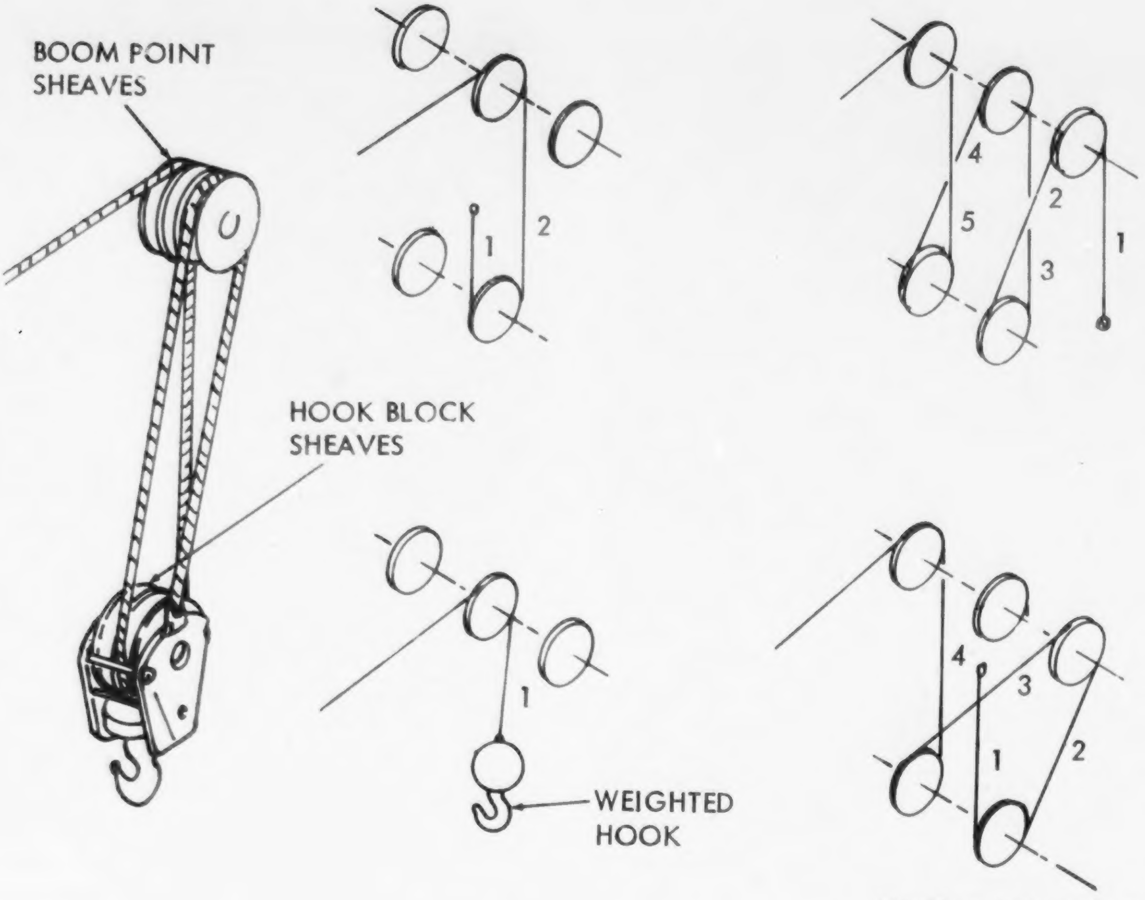
(2) Use wedges or a hydraulic jack to relieve the weight of the boom on the boom foot pins, and remove the pins. Refer to figure 2–9.

(3) Disconnect the boom backstops from the gantry A-frame and lay the backstops on the top of the boom. Refer to figure 2–10.

(4) Drive the carrier away from the boom.

2–6. Clamshell Conversion

a. General. The truck crane may be converted to clamshell operation by installing the crane



ME 3810-288-12/2-15

Figure 2-15. Main hoist line reeving.

boom (para. 2-5) and a clamshell bucket. The following components are necessary for the equipment conversion; the crane boom components (para. 2-5), clamshell bucket, bucket holding and closing lines, tagline winder, and tagline. The crane hoist cable may be used for the bucket holding line, but if additional depth below ground level is desired, longer holding and closing lines must be installed. Refer to table 1-1, Cable Specifications.

b. Installation. Install the crane boom, backstops, and boom hoist cable as described in paragraph 2-5.

c. Reeving.

(1) Swing the crane boom over the clamshell bucket. Lower the boom to approximately six feet above the ground beside the clamshell bucket.

(2) Reeve the closing line on the clamshell, around the left boom point sheave, and to the rear hoist drum. Secure the line to the drum (fig. 2-14) and wrap sufficient line on the drum to close the clamshell bucket.

(3) Reeve the holding line around the right boom point sheave, and to the front hoist drum. Secure the line to the drum, and wrap line on the drum until the same number of turns are on both drums. Attach the holding line loosely to the clamshell bucket.

(4) Raise the boom to the working angle. Raise the clamshell bucket, using both lines, until the second layer begins on the rear (closing line) drum. The second layer should begin on the front drum at the same time. If it does not, adjust the point of attachment of the holding line to the bucket.

(5) Cut both lines and secure them to the bucket.

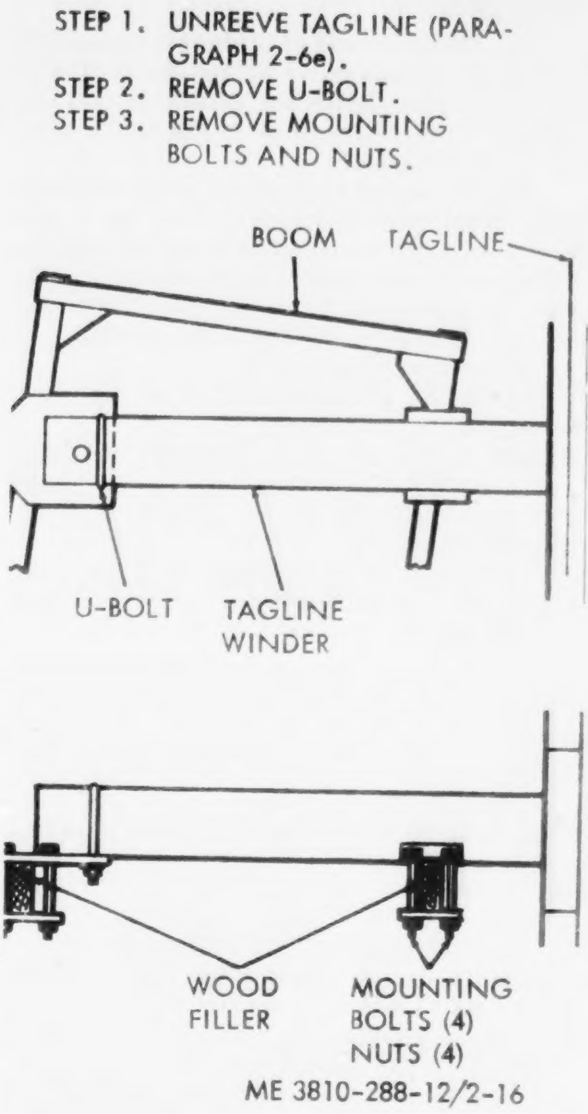

STEP 1. UNREEVE TAGLINE (PARAGRAPH 2-6e).
STEP 2. REMOVE U-BOLT.
STEP 3. REMOVE MOUNTING BOLTS AND NUTS.
BOOM
TAGLINE
U-BOLT
TAGLINE WINDER
WOOD FILLER
MOUNTING BOLTS (4) NUTS (4)
ME 3810-288-12/2-16

Figure 2-16. Tagline winder installation.

d. Tagline Winder.

(1) With a suitable lifting device, lift the tagline winder into position between the chords of the boom base section, near the upper end of the section.

Note. Where there is no interference with machine operation, mount the tagline winder with the cable drum on the side away from the operator, to reduce interference with the operator's vision.

(2) Position the tagline winder at an angle on the boom so that the tagline drum is in line with the boom point, and so that the tagline will reel straight off the drum when the clamshell bucket is at half the height of the boom point (fig. 2-16).

(3) Secure the tagline winder to the boom, using wood filler blocks as necessary.

(4) The tension on the tagline winder cable may be increased or decreased as necessary to keep the clamshell bucket from oscillating. To adjust the tension initially, place four or five wraps on the drum, and secure the tagline to the bridle chain. Additional wraps on the tagline drum will increase cable tension; fewer wraps will decrease cable tension.

e. Unreeving the Tagline Winder.

(1) Raise the boom until the clamshell bucket can be placed on the ground approximately 10 feet from the base of the boom, to relieve the spring tension on the tagline winder. If necessary, lower the boom to reduce the tension further.

(2) Remove the cable from the bridle chain.

Caution: **If there is tension on the tagline, do not release the tagline suddenly; to do so may cause damage to the tagline winder.**

(3) Release the tagline slowly by holding a slight tension on it until all of the cable is taken up on the reel and the end is fastened to prevent the reel from unwinding.

Note. The tagline winder should be left on the boom when not in use.

f. Unreeving the Clamshell.

(1) Release the drum brakes and unspool the holding and closing cables from the front and rear drums.

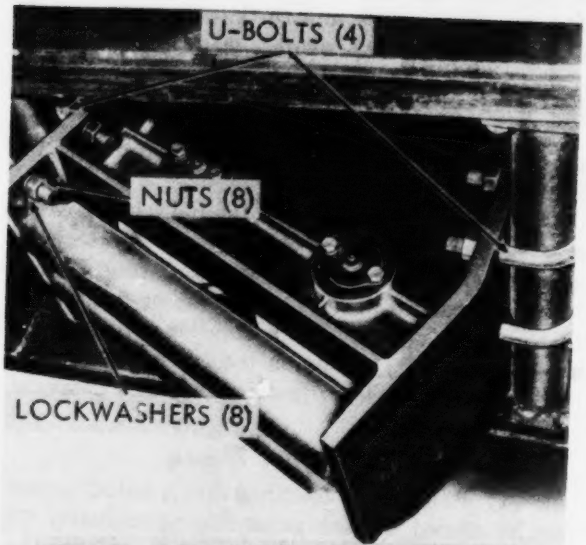
(2) Remove the cable wedges from the dead-end sockets on the clamshell, and remove the closing and holding cables.

(3) Remove the cable wedges from both cable drums, and free the closing and holding cables.

(4) Pull the cables free of the drums and the boom point sheaves, and lay them out straight on the ground.

(5) Roll the cables into a coil and secure them with wire. Label the cables for future use.

(6) Remove the boom hoist cable and boom (para. 2-5).



STEP 1. USING SUITABLE LIFTING DEVICE, POSITION FAIRLEAD AS SHOWN.
STEP 2. INSTALL U-BOLTS, LOCKWASHERS AND NUTS.

ME 3810-288-12/2-17

Figure 2-17. Fairlead, removal and replacement.

2–7. Dragline Conversion

a. General. The truck crane may be converted to dragline operation by installing the crane boom (para. 2–5) and a dragline bucket. The following components are necessary for the equipment conversion; the crane boom components (para. 2–5), drag bucket, bucket hoist and drag lines, and fairlead. The crane hoist cable may be used for the bucket hoist line, but if additional reach and depth are desired, a longer cable must be installed. Refer to table 1–1.

b. Installation and Reeving.

(1) Install the crane boom, backstops, and boom hoist cable as described in paragraph 2–5.

(2) Install the fairlead (fig. 2–17).

(3) Reeve the hoist cable over the center boom point sheave and secure it to the rear drum. Secure the remaining free end to the cable socket on the dump sheave chain (fig. 2–18).

Note. When inserting the cable end back into the cable socket, do not let it protrude on the opposite side more than one inch.

(4) Reeve the drag cable through the fairlead and secure it to the front drum. Reeve the remaining free end through the three-way socket and secure it.

(5) Insert one end of the bucket dump cable through the three-way socket and secure it with the cable wedge. Reeve the remaining free end over the dump sheave, down to the bucket arch, and deadend the cable.

(6) The bucket teeth should be approximately 12 inches higher than the heel of the bucket when the bucket is suspended in midair and the drag cable is pulled tight. Remove the dump cable from the deadend socket at the top of the bucket arch and lengthen or shorten it if necessary.

c. Removing and Unreeving.

(1) Lower the dragline bucket onto wood blocking in the desired location.

(2) Remove the cable wedges from the three-way socket and the deadend socket on the bucket arch. Unreeve the bucket dump cable from the dump sheave.

(3) Pull the hoist and drag cables free of the drag bucket, and unspool the cables from the front and rear drums.

(4) Remove the cable wedges from both drums, and free the hoist and draglines. Pull the cables free of the drums and the boom point sheaves.

(5) Lay the hoist, drag, and bucket dump cables straight on the ground. Roll the cables into coils and secure them with wire. Label the cables for future use.

(6) Remove the fairiead (fig. 2–17).

(7) Remove the boom hoist cable and boom (para 2–5).

2–8. Piledriver Conversion

a. General. The truck crane may be converted to piledriver operation by installing the crane boom and the piledriver. Paragraph 2–5 lists the crane boom components required. The piledriver consists of the catwalk, piledriver guides, hammer, and leads.

b. Installation.

(1) Install the crane boom, backstops, and boom hoist cable as described in paragraph 2–5.

(2) Place the lead sections on a flat surface in a horizontal position. Bolt one top lead section and four lower lead sections together. Refer to figure 2–19.

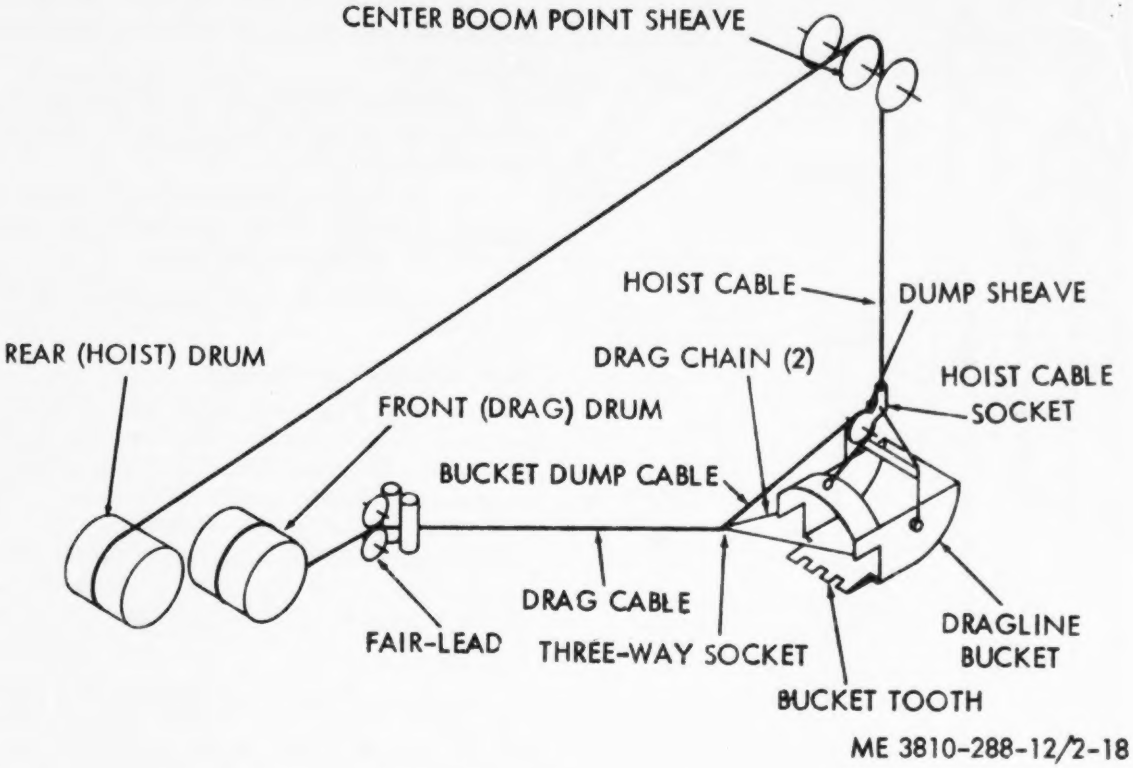

CENTER BOOM POINT SHEAVE
HOIST CABLE
DUMP SHEAVE
REAR (HOIST) DRUM
DRAG CHAIN (2)
HOIST CABLE SOCKET
FRONT (DRAG) DRUM
BUCKET DUMP CABLE
DRAG CABLE
DRAGLINE BUCKET
FAIR-LEAD
THREE-WAY SOCKET
BUCKET TOOTH
ME 3810-288-12/2-18

Figure 2-18. Dragline reeving diagram.

(3) Lower the boom to horizontal position in line with the upper end of lead assembly, and bolt securely to the outside of adapter plates on the boom point Refer to figure 2-20.

(4) Install the hammer cable in the drum socket in the front cable drum and secure with the cable wedge. Lead the hammer cable from the drum out over the left boom point sheave. Refer to figure 2-21, reeving diagram.

(5) Install the pile hoist cable in the drum socket in the rear cable drum and secure with the cable wedge. Lead the pile hoist cable from the drum out over the right boom point sheave.

(6) Install a thimble and the pile hoist cable through the pile hook and secure with three cable clamps.

(7) Back the truck crane slowly toward the piledriver leads, at the same time hoisting the boom until the leads are vertical.

(8) Raise the boom until the bottom of the leads clear the hammer, and position the leads over the hammer.

(9) Secure the piledriver hammer cable to the eye on the top of the hammer with a cable wedge, pin, and cotter pins, and raise the hammer into the leads.

(10) Swing the boom into position over the pile cap. Lower the hammer and secure the pile cap to the hammer with the wire rope sling. Raise the hammer and lift the cap into the leads.

(11) Refer to figure 2-20 and install the catwalk to the foot of the boom and the leads; adjust the catwalk so the leads are vertical, and bolt the catwalk sections together.

c. Removing the Piledriver.

(1) Lower the hammer enough to allow slack in the wire rope sling. Remove the sling and move the piledriver clear of the cap.

(2) Remove the bolts and nuts securing the catwalk sections. Raise the boom enough to clear

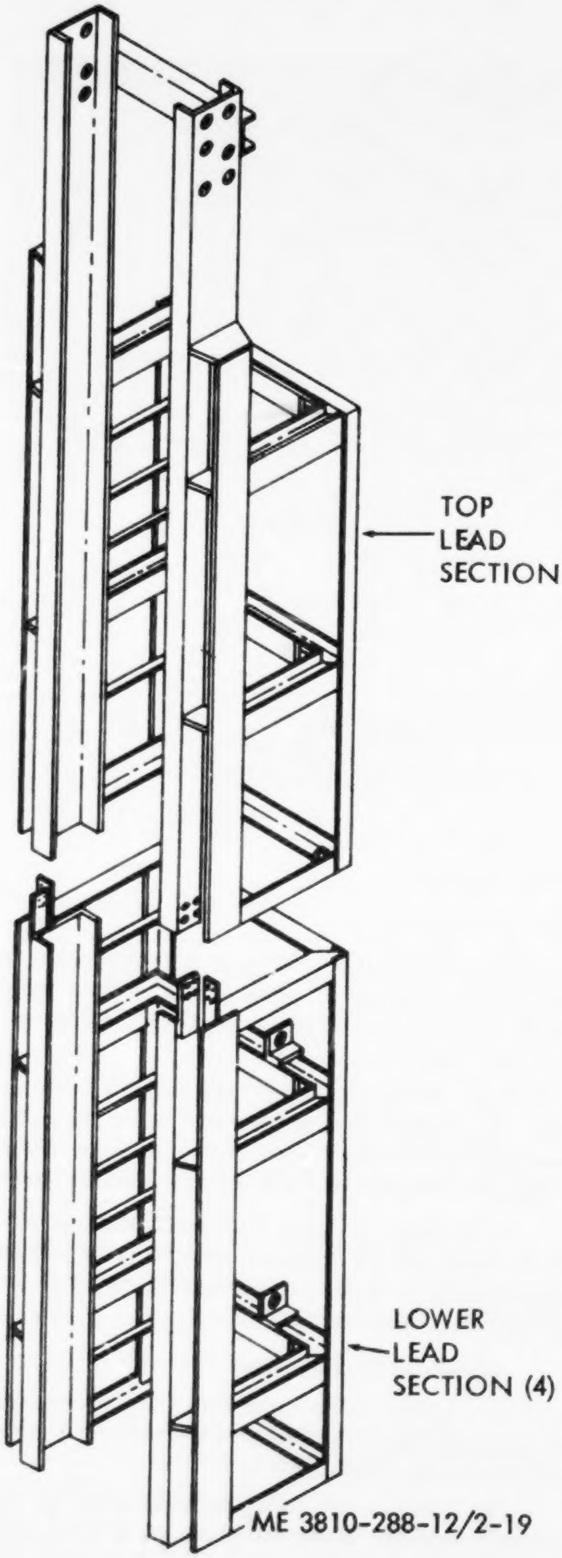


Figure 2-19. Assembling piledriver lead sections.

the hammer and lower the hammer to the ground. Remove the cable from the hammer.

(3) Remove the bolts securing the catwalk to the leads and the boom, and lower the catwalk to the ground.

(4) Lower the leads to the ground and slowly drive the carrier forward. At the same time, lower the boom to the wood blocks.

(5) Remove the piledriver lead adapters and leads as shown in figures 2-19 and 2-20. Secure the pile lead adapters to the leads.

(6) Remove the boom hoist cable and boom (para 2-5).

2-9. Backhoe Conversion

a. General. The truck crane may be converted to backhoe operation by installing the backhoe front-end attachment. The following components are necessary for the equipment conversion; backhoe boom, dipper handle, backhoe bucket, pitch brace, drag padlock sheave, hoist padlock sheave, gantry mast, boom foot pins, boom hoist cable, pull cable, and mast suspension cable.

b. Installation.

Note. To install the backhoe boom, a cribbing will be necessary to support the boom in a horizontal position. The cribbing must be high enough to bring the boom into position with the boom foot lugs on the revolving frame, as shown in figure 2-22.

(1) With the base of the backhoe boom assembly cribbed up to the height of the boom foot lugs on the revolving frame, swing the revolving frame to face the rear of the carrier. Carefully back the carrier up to the cribbed up boom, so that the bores in the boom foot lugs on the revolving frame are aligned with the bores in backhoe boom foot. Install the boom to the revolving frame with the boom foot pins and lock plates.

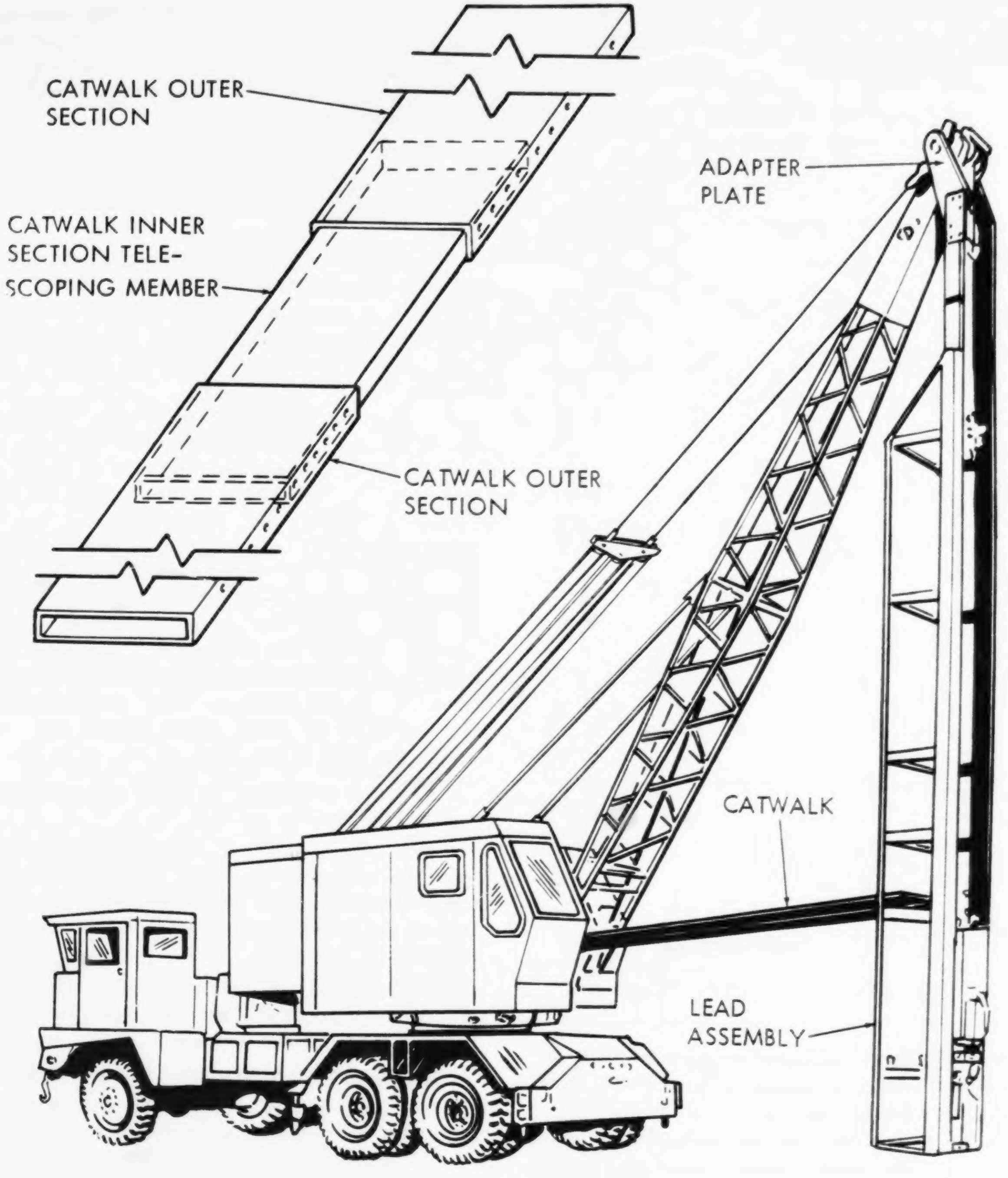
(2) Skid the gantry mast along on top of the boom into place on the revolving frame. Make certain that the small cable guide sheave at the top of the gantry mast points toward the crane, and install the gantry mast foot pins.

(3) Raise the gantry frame by hand, and lean it against the crane cab.

c. Reeving.

(1) Unroll and stretch the gantry suspension cable out on the ground on the right side of the boom.

(2) Reeve the backhoe auxiliary gantry cable as shown in figure 2-23.


CATWALK OUTER SECTION
CATWALK INNER SECTION TELE-SCOPING MEMBER
CATWALK OUTER SECTION
ADAPTER PLATE
CATWALK
LEAD ASSEMBLY

ME 3810-288-12/2-20

Figure 2-20. Piledriver lead and adapter installation.

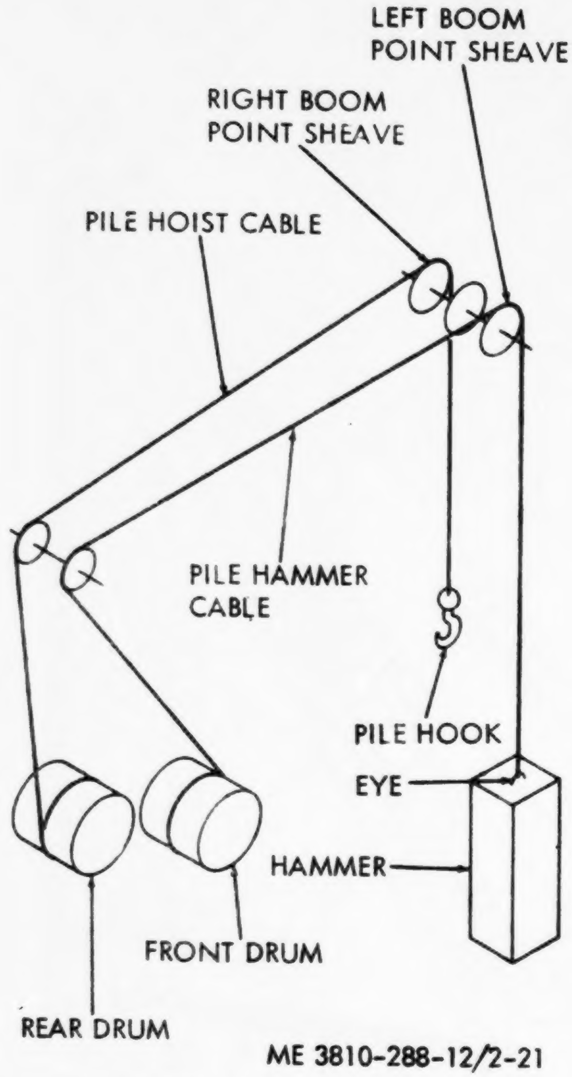


Figure 2-21. Piledriver reeving diagram.

(3) Secure the gantry suspension line to the boom hoist drum as shown in figure 2-14. Spool the slack cable on the drum.

(4) Install the gantry frame hold down cable (½" dia. x 8'-6" long) between the revolving frame and the upper end of the gantry frame.

(5) Unroll and stretch the digging cable out on the ground on the right side of the boom.

(6) Reeve the digging cable as shown in figure 2-24.

(7) Secure the digging cable to the cable drum as shown in figure 2-14.

(8) Raise the gantry mast to the working position, using the boom hoist lever. Spool the slack hoist cable on the boom hoist drum slowly, making certain that the cable wraps evenly on the drum the first time.

(9) Unroll and stretch the hoist cable out on the ground on the right side of the boom.

(10) Reeve the hoist cable as shown in figure 2-25.

(11) Extend the dipper out as far as it will go, with the dipper on the ground. Secure the hoist line to the cable drum as shown in figure 2-14 and take up two wraps on the front cable drum. Secure the other end of the cable to the boom.

d. Adjust the Backhoe Pitch Braces. The backhoe pitch braces (fig. 2-22) contain four holes in each brace for adjustment. Position the backhoe boom over the rear of the carrier and extend the dipper handle until the dipper teeth are in the vertical position. Lower the dipper to the ground and remove the nut and threaded pin which secure the braces to the dipper handle. To shorten the braces, move the carrier backward slowly until the holes in the braces are alined with the holes in the dipper handle. To lengthen the braces, move the carrier forward. After the holes have been alined, install the threaded pin and nut.

e. Unreeving the Backhoe Digging Cable.

(1) Pull the dipper in under the boom and lower to the ground.

(2) Release the front cable drum brake, and spool the cable off the drum. Remove the cable wedge from the drum socket and pull the cable free of the drum and the cable guide sheave on the boom.

(3) Remove the wedge from the dead-end socket on the boom and pull the cable free of the padlock, guide sheave, and boom.

(4) Lay the cable out straight on the ground.

(5) Roll the cable into a coil and secure it with wire. Label the cable for future use.

f. Unreeving the Backhoe Hoist Cable.

(1) Release the rear cable drum brake, and spool the cable from the rear cable drum. Remove the cable wedge and pull the cable free of the drum.

(2) Remove the cable wedge from the dea

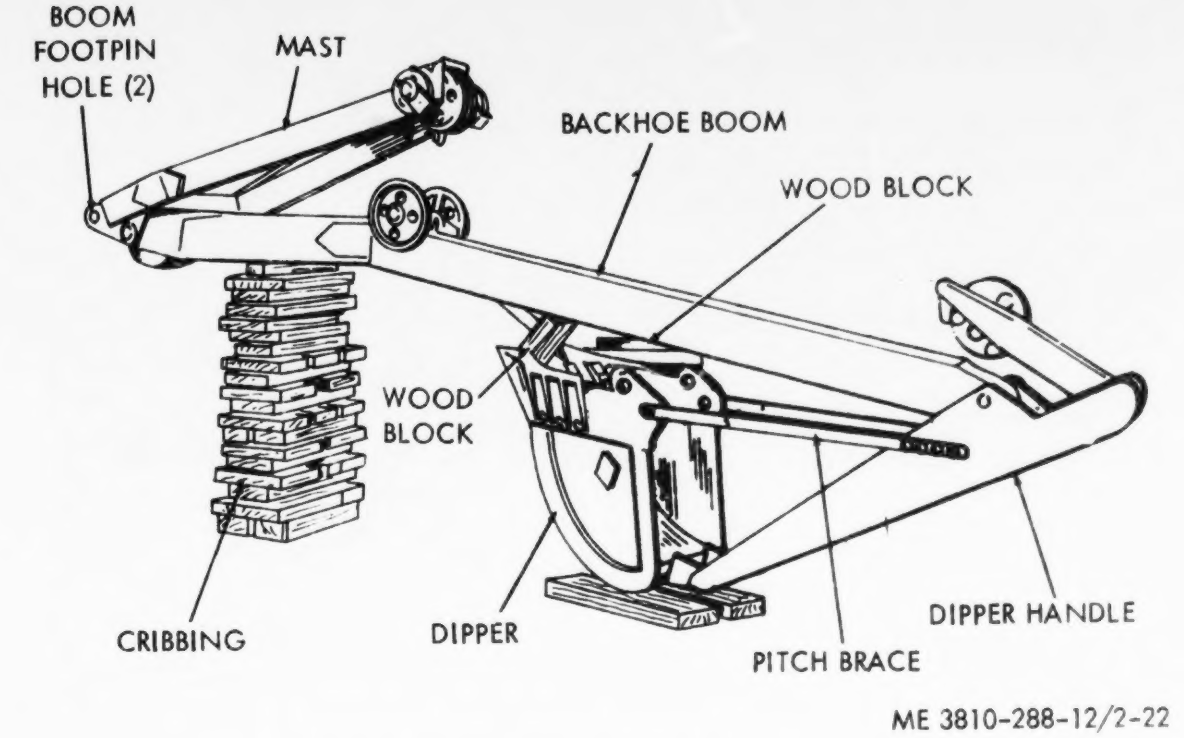

BOOM FOOTPIN HOLE (2)
MAST
BACKHOE BOOM
WOOD BLOCK
WOOD BLOCK
CRIBBING
DIPPER
DIPPER HANDLE
PITCH BRACE
ME 3810-288-12/2-22

Figure 2-22. Cribbing prepared for backhoe boom assembly, installation and removal.

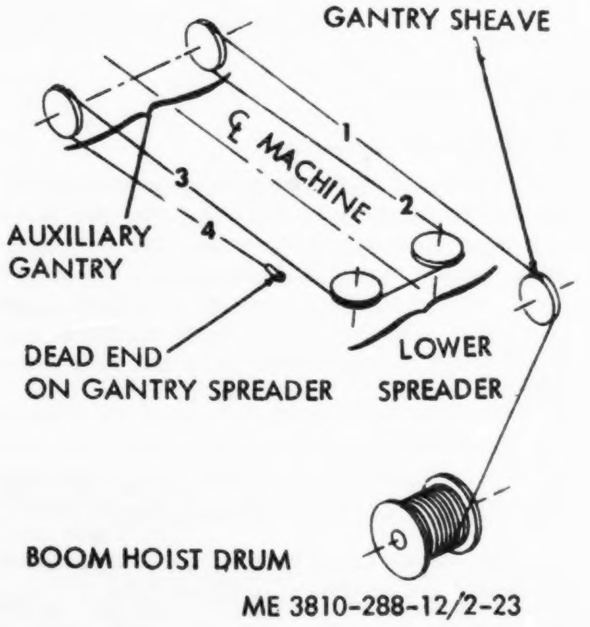

GANTRY SHEAVE
℄ MACHINE
1
2
3
4
AUXILIARY GANTRY
DEAD END ON GANTRY SPREADER
LOWER SPREADER
BOOM HOIST DRUM
ME 3810-288-12/2-23

Figure 2-23. Backhoe auxiliary gantry suspension reeving.

end socket on the hoist padlock sheave, and pull the cable free of all sheaves.

(3) Lay the cable out straight on the ground.

(4) Roll the cable into a coil and secure it with wire. Label the cable for future use.

g. Unreeving the Backhoe Mast Suspension Cable.

(1) Pull the dipper in under the boom and lower it to the ground.

(2) Slack off on the mast suspension cable and lower the mast forward to rest on the boom.

(3) Spool the cable off the boom hoist drum, and remove the cable wedge from the drum socket.

(4) Remove the wedge from the dead-end socket on the gantry A-frame.

(5) Pull the cable free of all sheaves and the mast. Lay the cable out straight on the ground.

(6) Roll the cable into a coil and secure it with wire. Label the cable for future use.

h. Removing the Backhoe Boom.

(1) Raise the boom and dipper off the

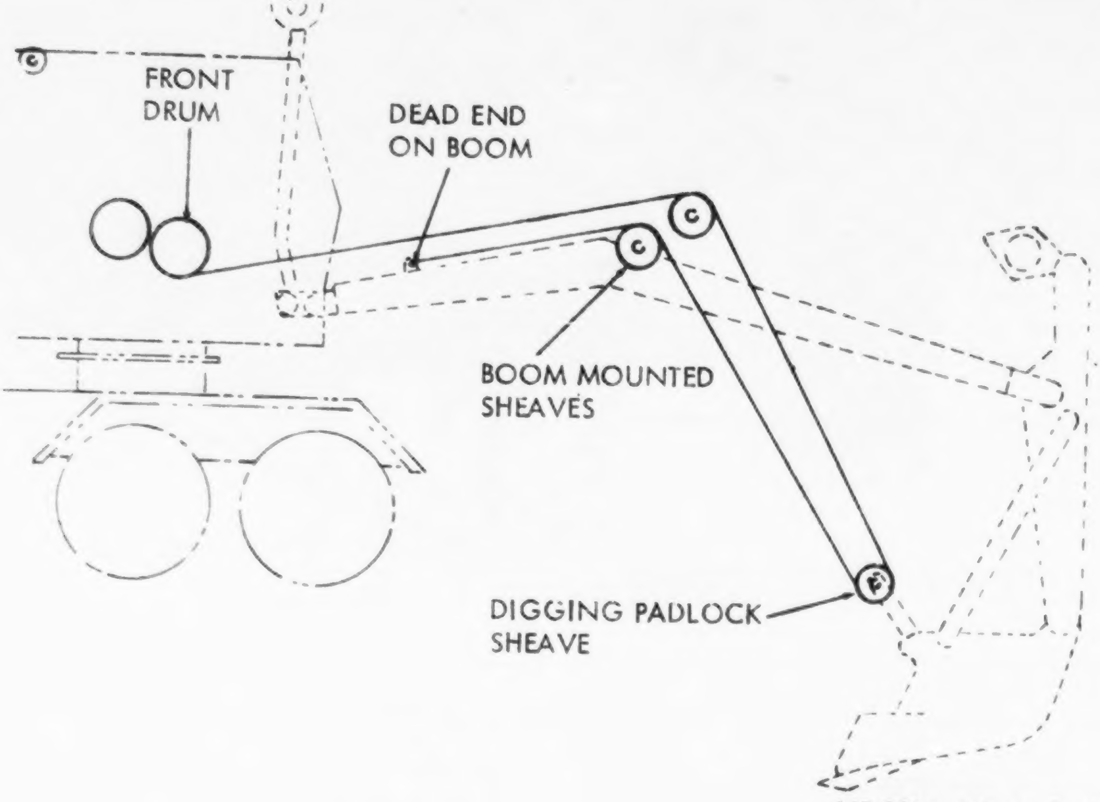


Figure 2-24. Backhoe digging cable reeving.

ground. Pull the dipper in under the boom, and lower the dipper onto wood blocks (fig. 2-22). Crib the base of the boom as shown in figure 2-22.

(2) Remove the digging cable, hoist cable, and mast suspension cable. Refers to figures 2-23, 2-24 and 2-25.

(3) Use a wedge between the cribbing and boom to remove the weight of the boom from the boom foot pins.

(4) Remove the boom foot pins, and drive the boom foot pins out of the boom foot lugs, releasing the backhoe boom attachment from the truck crane revolving frame.

(5) Drive the carrier slowly, away from the backhoe attachment.

Caution: **Use care when swinging the revolving frame without a boom, since it will tend to be unbalanced toward the counterweight end.**

2-10. Shovel Conversion

a. General. The truck crane may be converted to shovel operation by installing the shovel attachment. The following components are necessary for the equipment conversion; the shovel boom, saddle block, dipper stick, dipper, boom foot roller assembly, crowd chain tightener and crowd chain, special shovel front and rear drum laggings which are illustrated in figure 2-26.

b. Installation.

(1) Install the crowd sprocket lagging on the front drum as instructed on figure 2-27.

(2) Install the split rear drum lagging on the rear drum as shown on figure 2-26.

(3) Install the crowd chain tightener as instructed on figure 2-28.

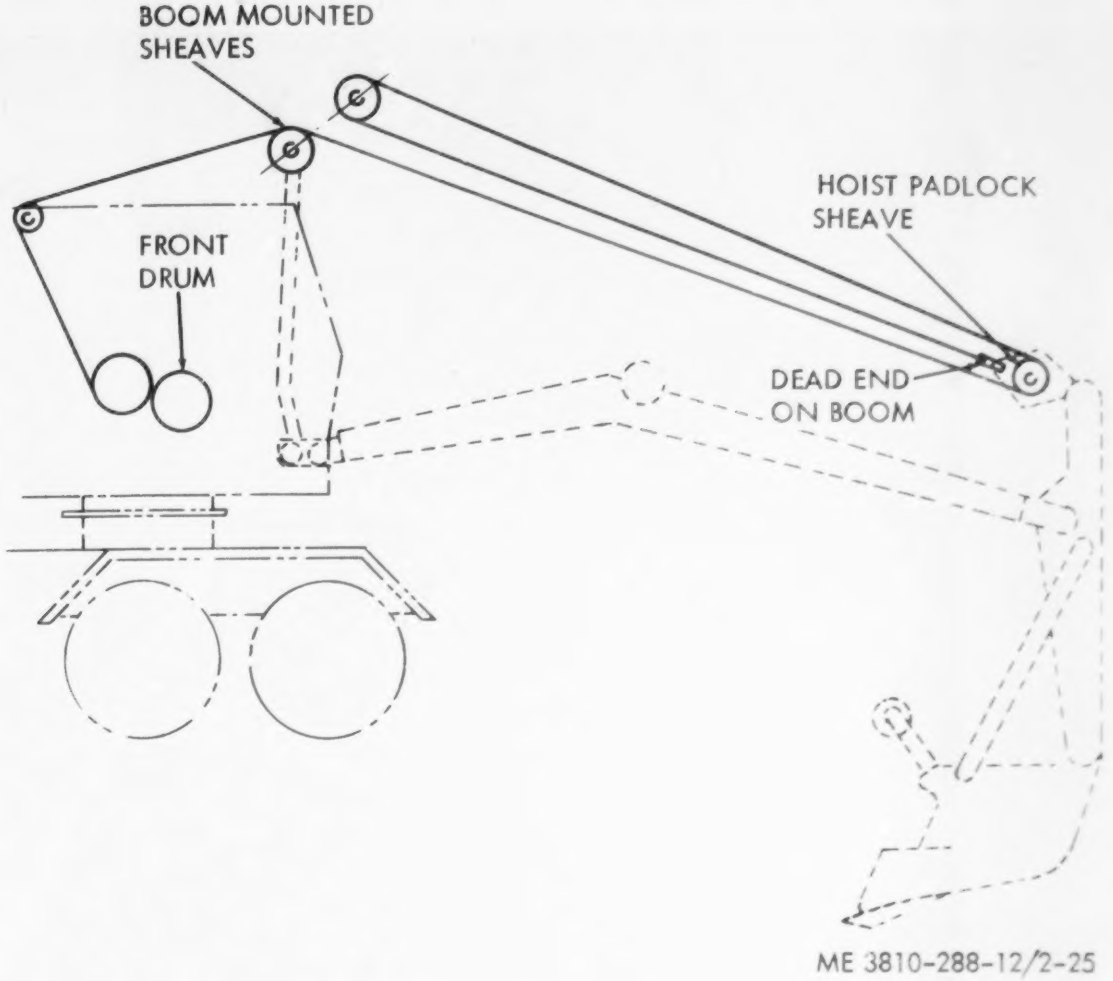


Figure 2-25. Backhoe hoist cable reeving.

(4) With the shovel boom cribbed to the height of the revolving frame boom foot lug holes (fig. 2-29), back the truck crane to the boom and align the boom foot pin holes in the boom with those in the revolving frame.

(5) Install the boom foot pin through the left boom foot lug. Using a suitable lifting device, support the boom foot drum in position, and install the boom foot pin through the drum and the right boom foot lug. Install the boom foot pin retaining plates, capscrews, lockwashers, and nuts (fig. 2-30).

(6) Install the crowd chain around the front drum sprocket, boom foot drum sprocket, and over the chain tightener. Adjust the chain as described in paragraph 3-27.

c. Reeving Crowd Cable.

(1) Unroll and stretch the crowd cable out on the ground on the right side of the boom.

(2) Reeve one end of the crowd cable under and around the boom foot drum, to the right cable socket on the drum, and secure the cable to the drum as shown in figure 2-14.

(3) Reeve the other end of the crowd cable around the front of the right groove in the shipper shaft roller, around the dipper stick rope thimble, around the front of the left groove in the shipper shaft roller, under and around the boom foot drum, to the left cable socket on the drum, and secure the cable to the drum (fig. 2-31).

d. Retract Cable Reeving.

(1) Unroll and stretch the retract cable out on the ground on the right side of the boom.

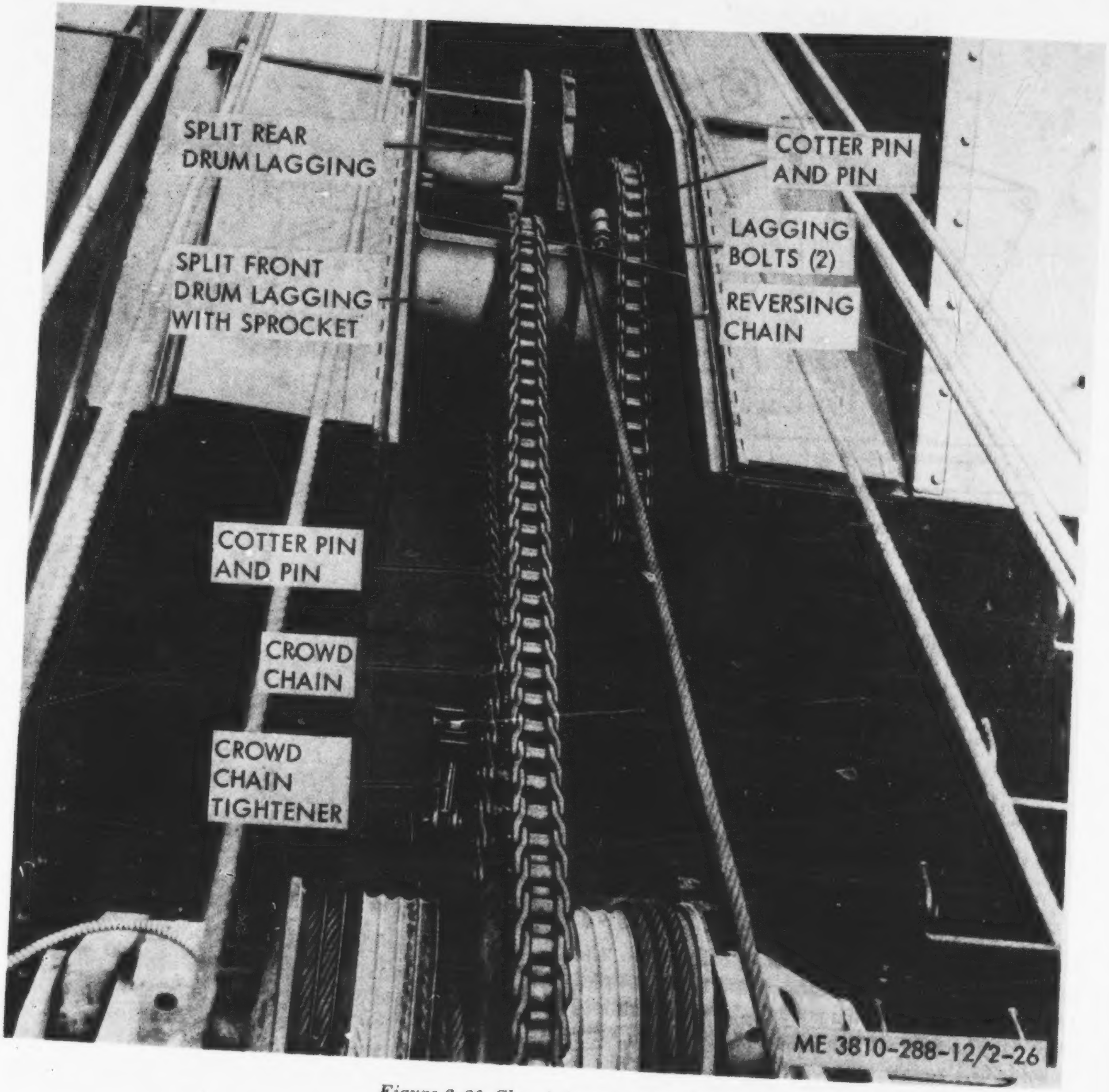

SPLIT REAR DRUM LAGGING
SPLIT FRONT DRUM LAGGING WITH SPROCKET
COTTER PIN AND PIN
CROWD CHAIN
CROWD CHAIN TIGHTENER
COTTER PIN AND PIN
LAGGING BOLTS (2)
REVERSING CHAIN
ME 3810-288-12/2-26

Figure 2-26. Shovel drum laggings.

(2) Secure one end of the cable to the dipper stick (fig. 2-31). Reeve the other end of the cable over the top of the center groove in the shipper shaft roller, and over and around the boom foot drum. Wrap the excess length around the drum, and secure the end to the drum.

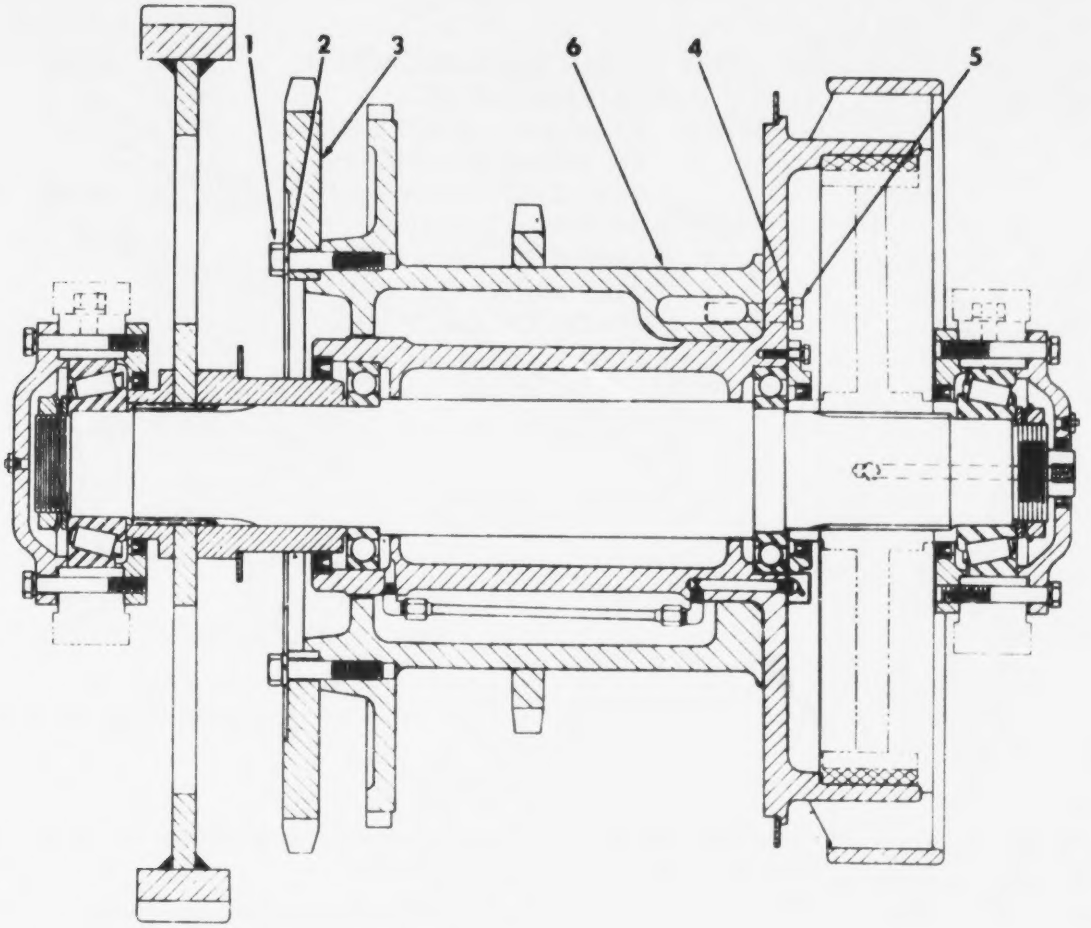
e. Reeving Shovel Dipper Hoist Cable.

(1) Unroll and stretch the dipper hoist cable out on the ground on the right side of the boom.

(2) Reeve one end of the cable up and over the left boom point sheave, down the top side of the boom, and over the left cable drum.

(3) Insert the end of the cable through the cable dead-end socket, loop it and insert the end of the cable back into the socket, taking care that the end does not protrude all the way through. Insert the cable wedge into the socket and pull the cable tight around it.

(4) Reeve the remaining free end of the cable around the padlock sheave on the shovel,



STEP 1. REFER TO PARAGRAPH 2-5 AND UNREEVE THE CABLES FROM FRONT AND REAR DRUMS. REFER TO FIGURE 2-26 AND REMOVE COTTER PIN, PIN AND REVERSING CHAIN.

STEP 2. REMOVE CAPSCREWS (5, FIGURE 2-27) AND LOCKWASHERS (4). REMOVE LAGGING BOLTS (FIGURE 2-26).

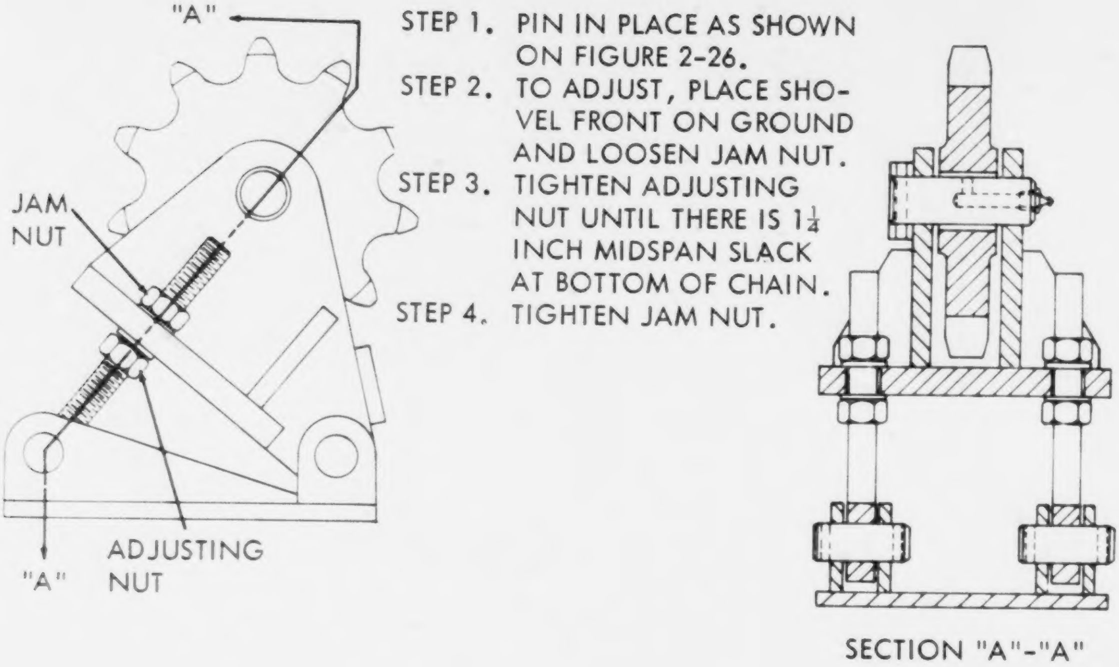
STEP 3. REMOVE ROPE LAGGING FROM THE FRONT DRUM, AND REMOVE REVERSING SPROCKET HALVES (3) FROM THE LAGGING HALVES BY REMOVING CAPSCREWS (1) AND LOCKWASHERS (2).

STEP 4. INSTALL REVERSING SPROCKET HALVES (3) ON CROWD SPROCKET LAGGING HALVES (6) AND INSTALL THE CROWD SPROCKET LAGGING ON THE FRONT DRUM. INSTALL CAPSCREWS (5) AND LOCKWASHERS (4).

1. Capscrew
2. Lockwasher
3. Sprocket halves
4. Lockwasher
5. Capscrew

ME 3810-288-12/2-27

Figure 2-27. Installing crowd sprocket lagging.



STEP 1. PIN IN PLACE AS SHOWN ON FIGURE 2-26.
STEP 2. TO ADJUST, PLACE SHOVEL FRONT ON GROUND AND LOOSEN JAM NUT.
STEP 3. TIGHTEN ADJUSTING NUT UNTIL THERE IS $1\frac{1}{4}$ INCH MIDSPAN SLACK AT BOTTOM OF CHAIN.
STEP 4. TIGHTEN JAM NUT.

ME 3810-288-12/2-28

Figure 2-28. Crowd chain tightener.

dipper, up and over the right boom point sheave, and to the cable socket on the boom (fig. 2-32).

f. Reeving Shovel Boom Hoist Cable.

(1) Unroll and stretch the boom hoist cable out on the ground on the right side of the boom.

(2) Reeve one end of the cable around the lower left gantry spreader sheave, around the inside left boom point sheave, around the upper gantry spreader sheave, around the outside left boom point sheave, and back to the dead-end on the gantry spreader (fig. 2-33).

(3) Reeve the other end of the boom hoist cable around the lower right gantry spreader sheave, around the inside right boom point sheave, around the upper right gantry spreader sheave, around the outside right boom point sheave, and down to the boom hoist drum.

(4) Secure the boom hoist line to the boom hoist drum as shown in figure 2-14. Spool the slack cable on the drum.

g. Reeving Shovel Dipper Trip Cable.

(1) Raise the dipper off the ground and crowd it out as far as it will go, and then lower it to the ground.

(2) Unroll and stretch the dipper trip cable out on the ground on the right side of the boom.

(3) Reeve the cable from the trip lever on the dipper stick, over the small sheaves on the shipper shaft, around the dipper trip motor eccentric, around the outside sheave on the shipper shaft, and back to the dead-end on the dipper stick (fig. 2-34).

h. Adjustments. All shovel front adjustments are covered in paragraph 3-27. Each adjustment listed in paragraph 3-27 must be made or checked before a machine converted to shovel operation is placed in service.

i. Unreeving Shovel Cables.

(1) To unreeve the shovel dipper trip cable, remove the cable clamp at the dipper trip lever and the dead end on the dipper stick. Pull the cable from the drum and sheaves. Coil the cable neatly and secure with wire. Label the cable for future use.

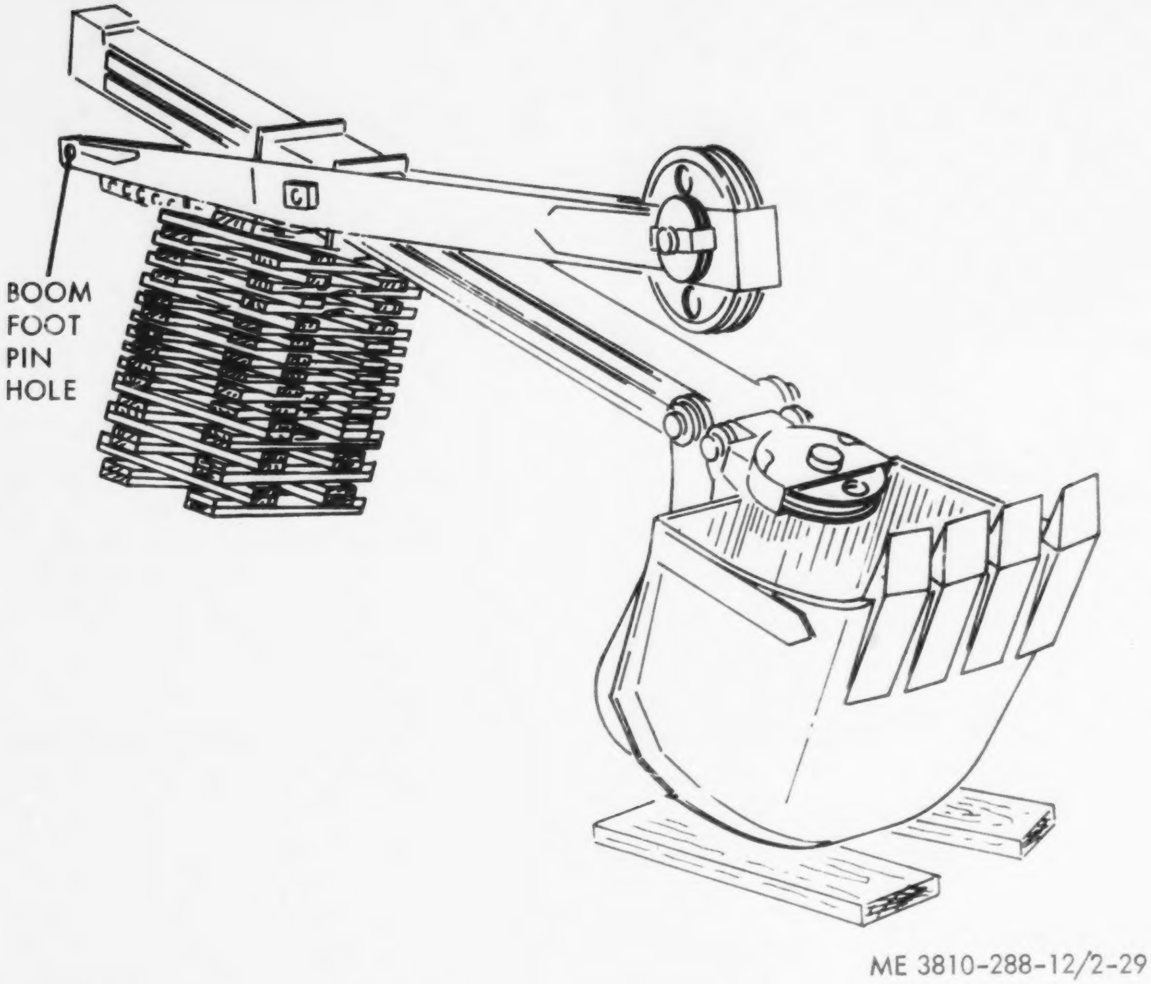


Figure 2-29. Cribbing the shovel boom assembly.

(2) To unreeve the boom hoist cable, hoist the dipper up and crowd it out beyond the boom point sheaves. Lower the boom onto blocking (fig. 2-29). Unspool the cable from the drum. Remove the cable wedge from the cable drum socket and free the cable. Pull the cable free of the drum and the boom point sheaves, and lay it out straight on the ground. Lubricate the cable as specified in paragraph 3-31. Roll the cable into a coil and secure it with wire. Label the cable for future use.

j. Removing Shovel.

(1) Prepare cribbing (fig. 2-29) under the base of the boom. Unreeve the hoist cable as described above.

(2) Remove the crowd chain by removing the cotter pin, pin, and connecting link. Lubricate, label, and store the chain.

(3) Disconnect the electrical line to the dipper trip motor.

(4) Remove capscrews, lockwashers, and the retaining plates at the boom foot pins, and remove the boom foot pins and boom foot drum from the revolving frame.

(5) Drive the carrier clear of the shovel boom assembly.

(6) Remove the front drum sprocket lagging. Coat the sprocket lagging and the boom foot drum sprocket with oil to prevent rust.

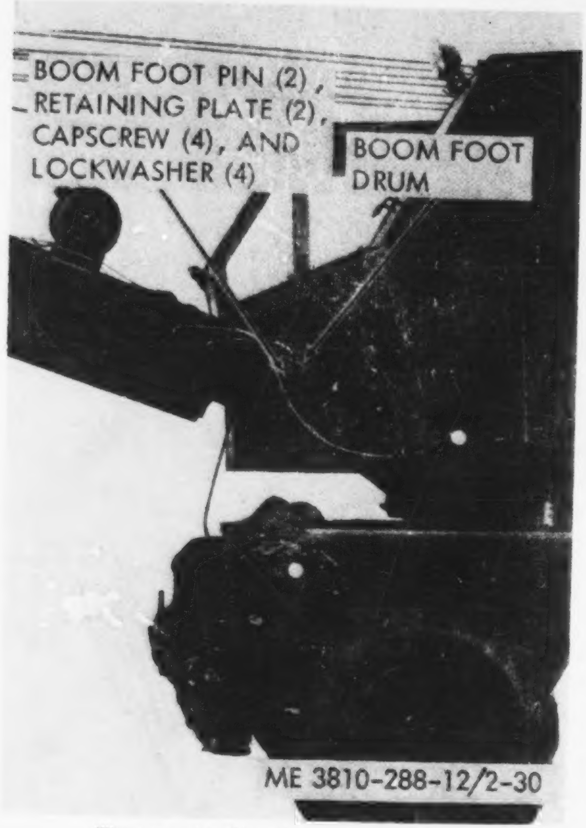

BOOM FOOT PIN (2),
RETAINING PLATE (2),
CAPSCREW (4), AND
LOCKWASHER (4)
BOOM FOOT
DRUM
ME 3810-288-12/2-30

Figure 2-30. Shovel boom installation.

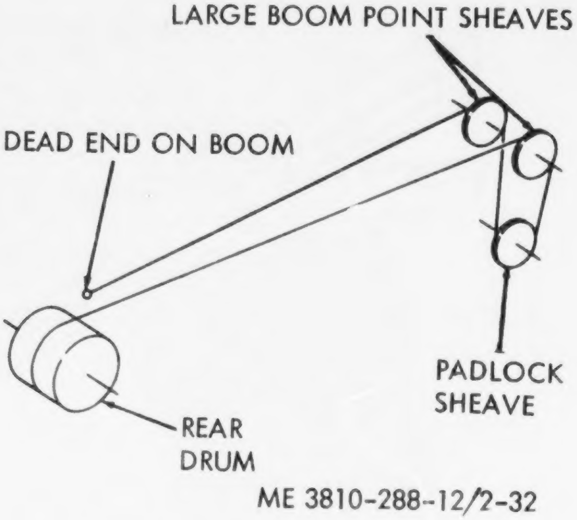

LARGE BOOM POINT SHEAVES
DEAD END ON BOOM
PADLOCK
SHEAVE
REAR
DRUM
ME 3810-288-12/2-32

Figure 2-32. Dipper hoist cable reeving.

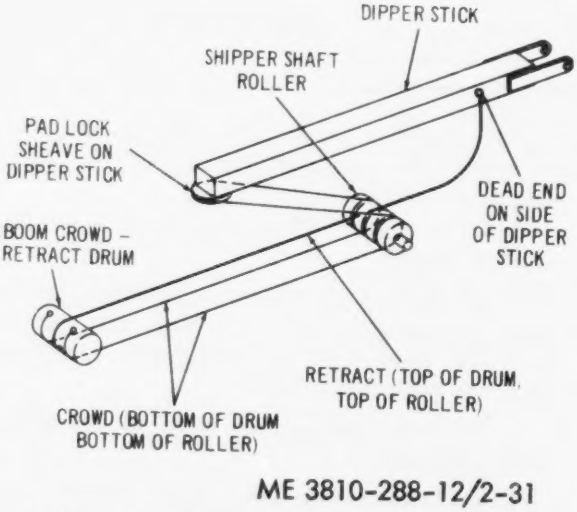

DIPPER STICK
SHIPPER SHAFT
ROLLER
PAD LOCK
SHEAVE ON
DIPPER STICK
DEAD END
ON SIDE
OF DIPPER
STICK
BOOM CROWD -
RETRACT DRUM
RETRACT (TOP OF DRUM,
TOP OF ROLLER)
CROWD (BOTTOM OF DRUM
BOTTOM OF ROLLER)
ME 3810-288-12/2-31

Figure 2-31. Crowd and retract cable reeving.

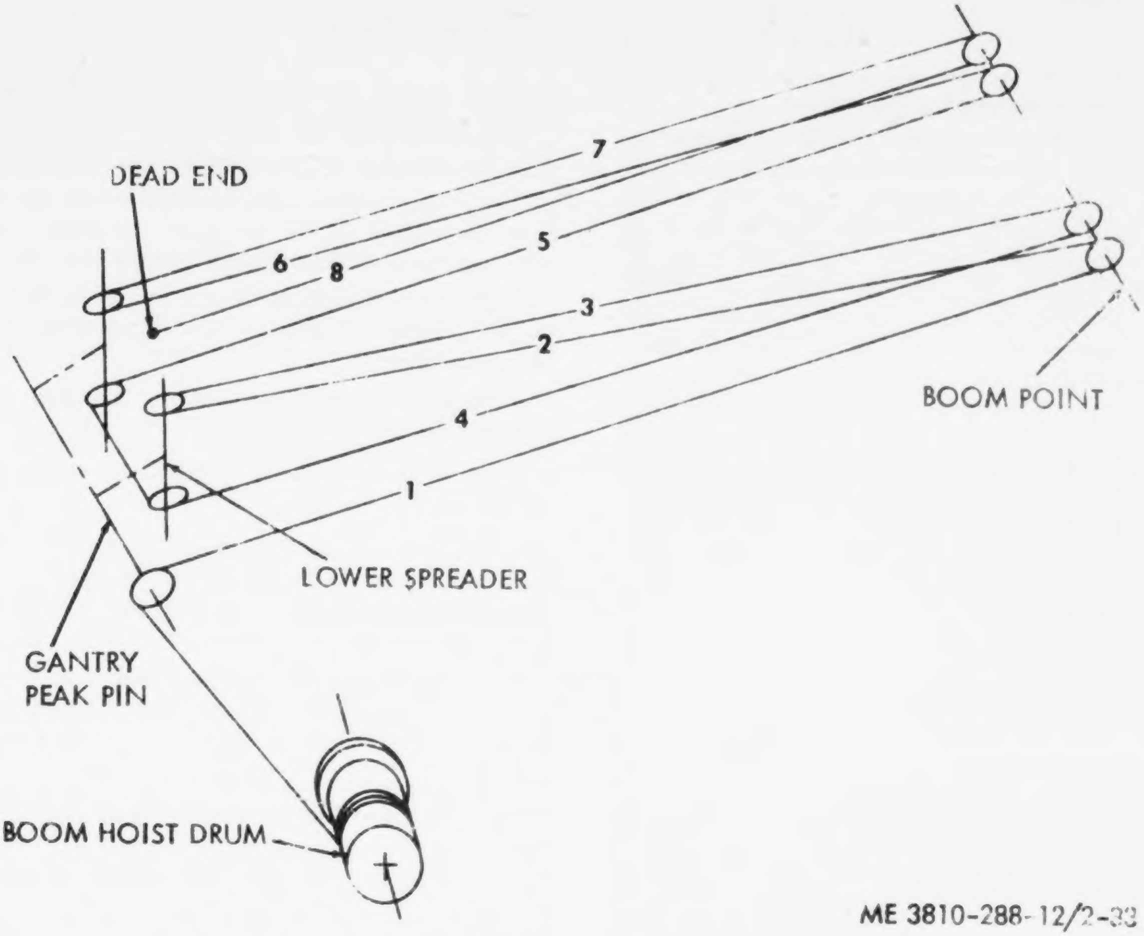
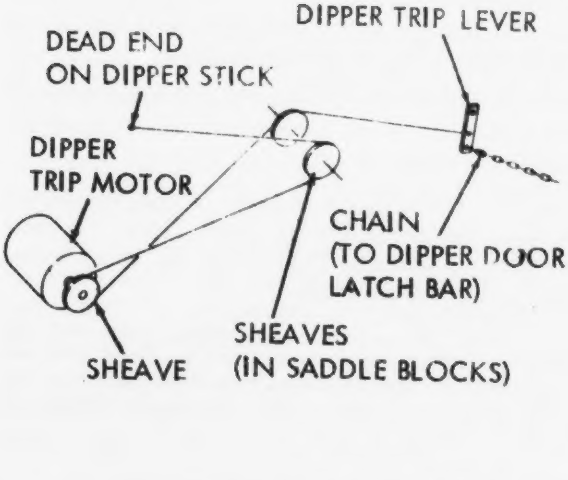

DEAD END
7
6
8
5
3
2
4
1
BOOM POINT
LOWER SPREADER
GANTRY PEAK PIN
BOOM HOIST DRUM
ME 3810-288-12/2-33

Figure 2-33. Boom hoist cable reeving.


DIPPER TRIP LEVER
DEAD END ON DIPPER STICK
DIPPER TRIP MOTOR
CHAIN (TO DIPPER DOOR LATCH BAR)
SHEAVES (IN SADDLE BLOCKS)
SHEAVE

ME 3810-288-12/2-34

Figure 2-34. Dipper trip cable reeving.

Section II. MOVEMENT TO A NEW WORK SITE

2-11. Dismantling for Movement

a. General. The truck crane can be transported readily, as it is mounted on its own carrier. Before moving the equipment, obtain information on road conditions and possible restrictions along the route due to clearances. Secure the crane cab by disengaging all clutches, setting all brakes, and installing the anti-rotation bars that brace the upper to the carrier frame. Refer to figure 2-35.

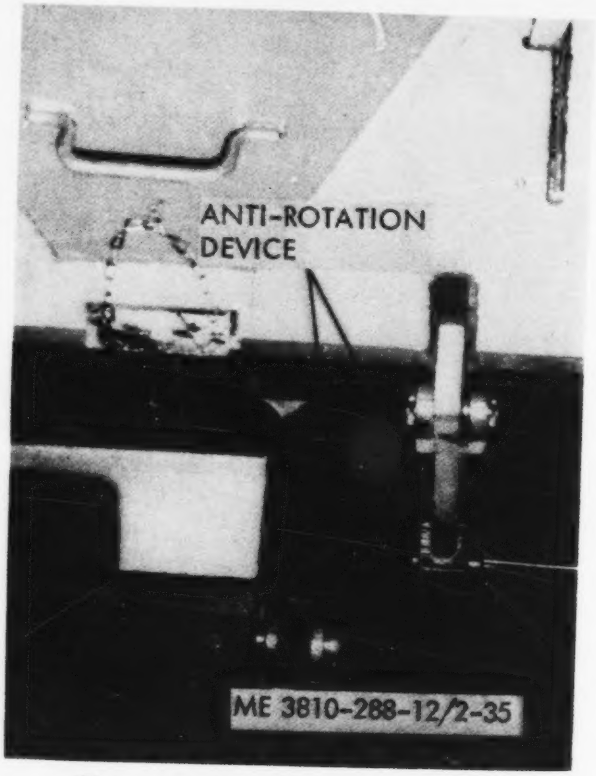


Figure 2-35. Anti-rotation device installed.

Caution: **Do not transport the truck crane with the piledriver front-end attachment installed.**

b. Transportation without Crane Boom.

(1) Lower the boom over the rear of the carrier to the horizontal position, and build up cribbing under the boom as shown in figure 2-7.

(2) Disconnect the boom hoist line dead end from the gantry frame, and take up the line onto the boom hoist drum.

(3) Remove the hook block, clamshell bucket, or drag bucket, and take up the main and secondary hoist lines onto the rear and front drums.

(4) Remove the boom backstops (fig. 2-10).

(5) Use wedges or a hydraulic jack to relieve the weight of the boom on the boom foot pins, and remove the boom foot pins, (fig. 2-9).

(6) Move the carrier away from the cribbed-up boom. Refer to figure 2-8 and disassemble the boom assembly.

c. Transportation with Crane, Clamshell, or Dragline Boom.

(1) Lower the boom to the boom cradle at the front of the carrier.

(2) Take up the slack in the boom hoist line so that the boom is supported by the boom hoist line just above the boom cradle. Set the boom hoist drum pawls (sec III).

(3) Make certain that the swing lock is set. Refer to figure 2-36. Connect the anti-rotation device rods. See figure 2-35.

(4) Secure the hook block to the underside of the boom and take up the slack in the hoist line.

(5) Be sure outriggers are retracted and pinned in place (fig. 2-5).

d. Transportation with Shovel or Backhoe.

(1) Swing the crane, with the dipper extended, until the boom is in line with the boom cradle. Engage the swing lock, and install the anti-rotation device rods (fig. 2-35).

(2) Lower the boom until it is approximately six inches above the boom cradle. Keep the boom hoist cable tight.

(3) Use a length of cable to snub the dipper stick to the carrier towing hooks. Draw this cable as tight as possible. Take slack out of all cables supporting the front end.

Note. For moves over straight, open road, the shovel or backhoe may be moved with the dipper stick and boom over the rear of the carrier. Faced this way, the boom can be quite low and the unit can be moved with safety.

2-12. Reinstallation after Movement

Refer to paragraph 2-3 for installation instructions after movement to a new work site.

Section III. CONTROLS AND INSTRUMENTS

2-13. General

This section describes the various controls and instruments, and provides the operator/crew with sufficient information to insure proper operation of the Model M320T truck crane.

2-14. Controls and Instruments

a. General. The crane operating controls and instruments are shown in figure 2-36. A description of each control is given below.

Note. The operator must study the information in this section, and be thoroughly familiar with the location and function of each control, before attempting to operate the machine.

b. Control Identification.

(1) *Swing clutch lever.* Push this lever forward (toward the boom point) to swing the upper to the left. Pull this lever backward to swing the upper to the right.

(2) *Front drum clutch lever.* Pull this lever backward (toward the operator) to wrap line on the front drum. Push this lever forward (away from the operator) to pay line off the front drum.

(3) *Rear drum clutch lever.* Pull this lever backward (toward the operator) to wrap line on the rear drum. Push this lever forward (away from the operator) to pay line off the rear drum.

(4) *Boom hoist clutch and brake lever.* Pull this lever backward (toward the operator) to wrap line on the boom hoist drum and raise the boom. Push this lever forward (away from the operator) to pay line off the boom hoist drum and lower the boom. Return the lever to the center (neutral) position to apply the boom hoist brake.

Note. The boom hoist drum pawl control (item 10 of this listing) must be used in conjunction with the boom hoist clutch and brake lever.

(5) *Engine throttle control.* Move this control forward to increase the engine speed. Move this control backward (toward the operator) to decrease engine speed.

(6) *Swing brake lever.* Push this lever fully forward to apply the swing brake. Pull this lever fully backward to release the swing brake.

(7) *Rear drum brake pedal.* Push this pedal down to apply the rear drum brake. Release pressure on the pedal to release the rear drum brake. To engage the ratchet type lock on this pedal, depress the toe of the pedal while releasing pressure on the pedal. To disengage the ratchet type lock, depress the heel of the pedal.

Caution: **Do not rely on the ratchet brake locks on the front or rear drum brake pedals to suspend a load. The operator must remain in a position of readiness, with feet on pedals, at all times that a load is suspended.**

(8) *Front drum brake pedal.* Push this pedal down to apply the front drum brake. Release pressure on the pedal to release the front drum brake. To engage the ratchet type lock on this pedal, depress the toe of the pedal while releasing pressure on the pedal. To disengage the ratchet type lock, depress the heel of the pedal.

(9) *Swing brake lock control.* Push this handle backward to engage the mechanical swing brake lock.

(10) *Boom hoist drum pawl control.* Push this handle backward to engage the safety pawl in the boom hoist drum ratchet.

Caution: **The boom hoist pawl must be engaged at all times, except when lowering the boom. Do not attempt to engage the boom hoist pawl while lowering the boom.**

(11) *Front drum pawl control.* Push this handle backward to engage the safety pawl in the front drum ratchet.

Caution: **The front drum pawl must be engaged while suspending a load. Do not attempt to engage this pawl while lowering a load.**

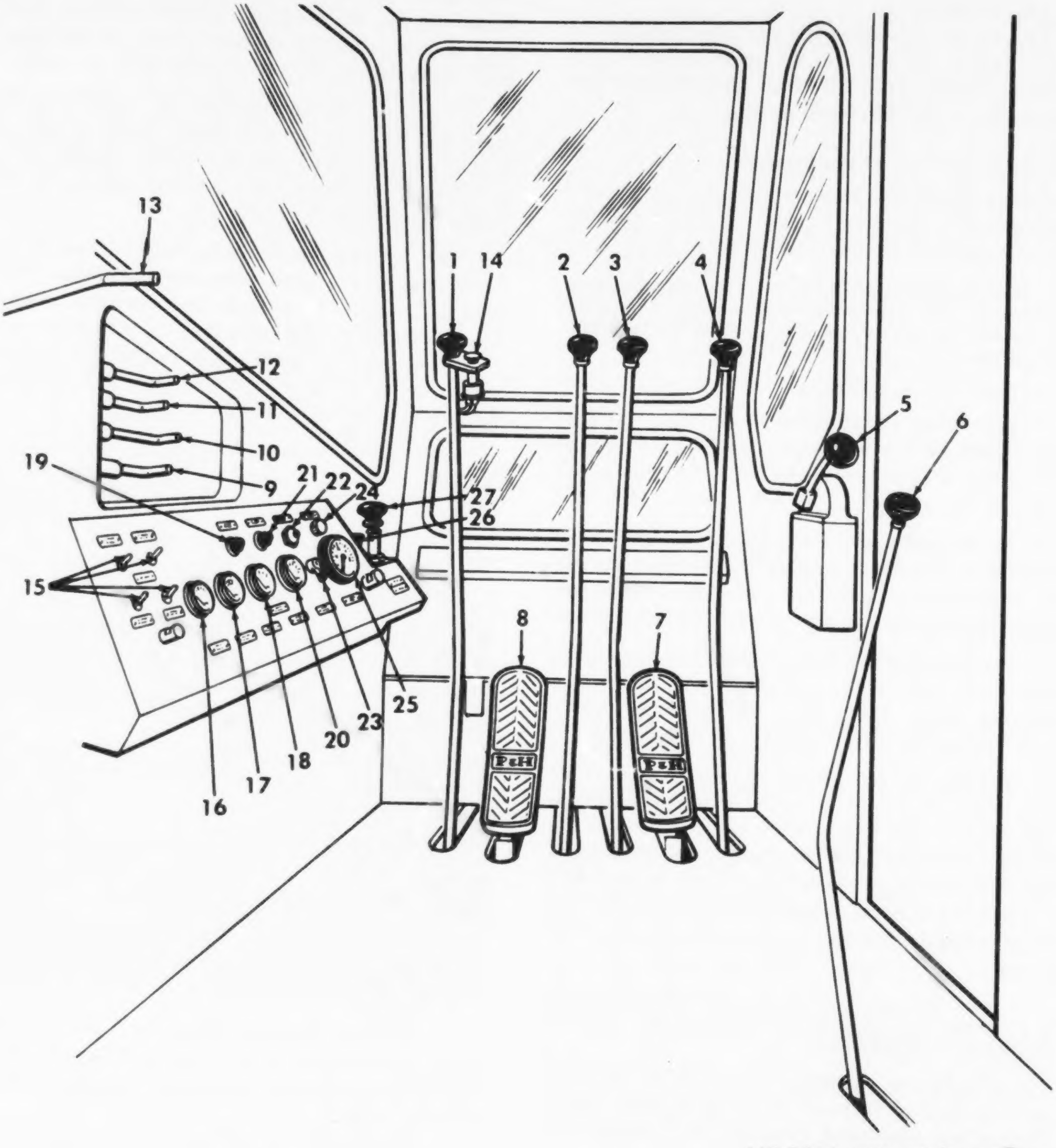
(12) *Rear drum pawl control.* Push this handle backward to engage the safety pawl in the rear drum ratchet.

Caution: **The rear drum pawl must be engaged while suspending a load on the rear drum line. Do not attempt to engage this pawl while lowering a load.**

(13) *Engine clutch lever.* Pull this lever fully backward to engage the engine clutch. Push this lever fully forward to disengage the engine clutch.

(14) *Horn button.* Depress this button to sound the warning horn.

(15) *Light switches.* Use these switches to


13
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P&H
P&H

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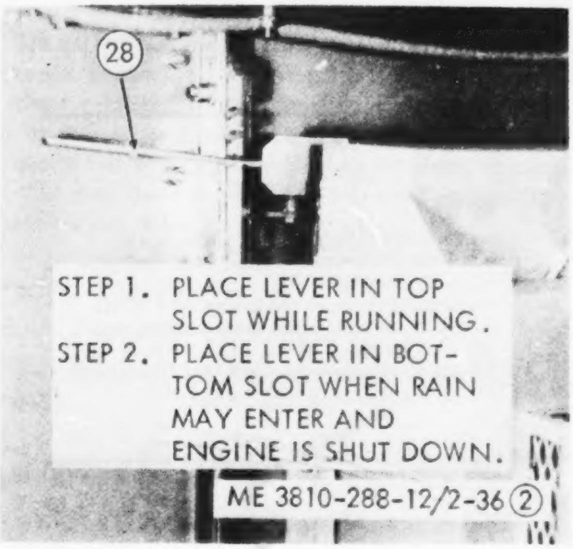
Figure 2-36. Control identification. (Sheet 1 of 2)

1. Swing clutch lever
2. Front drum clutch lever
3. Rear drum clutch lever
4. Boom hoist clutch and brake lever
5. Engine throttle control
6. Swing brake lever
7. Rear drum brake pedal
8. Front drum brake pedal
9. Swing brake lock control
10. Boom hoist drum pawl control
11. Front drum pawl control
12. Rear drum pawl control
13. Engine clutch lever
14. Horn button (or dipper trip switch)
15. Light switches
16. Engine fuel tank level gauge
17. Voltmeter
18. Engine oil pressure gauge
19. Engine oil pressure warning light
20. Engine temperature gauge
21. Engine temperature warning light
22. Starter button (engine)
23. Ignition switch
24. Cab heater switch
25. Engine tachometer
26. Choke control
27. Starting aid
28. Rain shutter lever

Figure 2-36. Control identification. (Sheet 1 of 2)



STEP 1. PLACE LEVER IN TOP SLOT WHILE RUNNING.
STEP 2. PLACE LEVER IN BOTTOM SLOT WHEN RAIN MAY ENTER AND ENGINE IS SHUT DOWN.

Figure 2-36. Control identification. (Sheet 2 of 2)

control the top and skirt mounted floodlights, interior cab light, and the panel illumination lights, as labeled.

(16) *Engine fuel tank level gauge.* This gauge indicates the level of the fuel in the crane fuel tank.

(17) *Voltmeter.* This meter indicates the condition of the battery, and the voltage output of the alternator when the engine is running. Typical indications of this meter are shown in figure 2-37.

(18) *Engine oil pressure gauge.* This gauge indicates the oil pressure in the crane engine.

(19) *Engine oil pressure warning light.* This light will be illuminated when the oil pressure in the crane engine is below a safe minimum.

(20) *Engine temperature gauge.* This gauge indicates the temperature of the coolant in the crane engine cooling system in degrees Fahrenheit.

(21) *Engine temperature warning light.* This light will be illuminated when the temperature of the coolant in the crane engine cooling system is above a safe maximum.

(22) *Starter button.* Depress this button to start the engine.

(23) *Ignition switch.* Turn this switch clockwise to turn on the engine ignition. Turn this switch counter-clockwise to turn off the engine ignition.

(24) *Cab heater switch.*

(25) *Engine tachometer—hourmeter.* This gauge indicates the engine speed in hundreds of revolutions per minute. It also contains an hourmeter, which indicates accumulated engine operating hours.

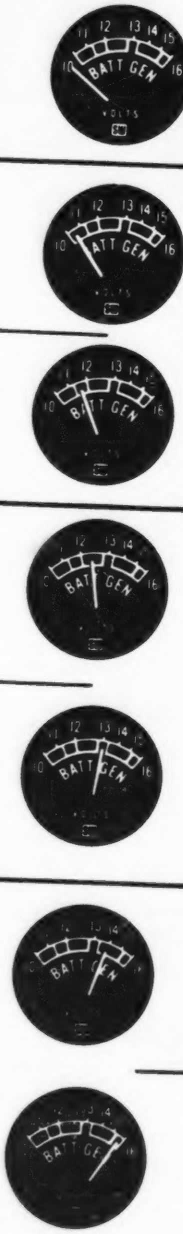
(26) *Choke control.* Lift this knob to close the carburetor choke valve.

(27) *Starting aid.* Refer to Section V for the operation of this control.

(28) *Rain shutter lever.* Open shutter when engine is to be operated.

Engine not running or running at slow idle.

Engine running fast enough to make generator * produce.



❶

DEAD OR DISCONNECTED BATTERY. DISCONNECTED OR BADLY CONNECTED METER.

❶

DISCONNECTED METER. ENGINE COULD NOT RUN WITH DEAD OR DISCONNECTED BATTERY UNLESS CIRCUIT WAS COMPLETED AROUND BATTERY.

❷

VERY LOW BATTERY CHARGE. ENGINE MIGHT NOT START.

❸

LOW BATTERY CHARGE. CONSTANT READING IN THIS AREA WOULD INDICATE NEED FOR CHECK ON GENERATOR AND VOLTAGE REGULATOR.

❷ ❸

WHEN METER POINTER STAYS BELOW 13.3 WITH THE ENGINE RUNNING FAST ENOUGH TO OPERATE GENERATOR, IT SHOWS THAT GENERATOR IS NOT OPERATING OR VOLTAGE REGULATOR IS OUT OF ADJUSTMENT, OR THAT CURRENT BEING DRAWN FROM BATTERY BY LIGHTS, HEATER FAN, OR OTHER LOAD, EXCEEDS GENERATOR OUTPUT.

❹

WELL-CHARGED BATTERY. THIS INDICATES A GOOD BATTERY AND ALSO THAT GENERATOR AND VOLTAGE REGULATOR ARE OPERATING PROPERLY.

❺

THE POINTER MIGHT REMAIN IN THIS POSITION TEMPORARILY WHEN THE ENGINE HAS BEEN STOPPED AFTER CONSIDERABLE USE, DUE TO A "SURFACE CHARGE" IN THE BATTERY. TO GET A CORRECT READING, TURN ON HEADLIGHTS FOR A FEW MINUTES.

❹ ❺

WHEN ENGINE IS STARTED, POINTER MAY STAY IN THIS AREA TEMPORARILY BUT SHOULD GRADUALLY RISE ABOVE 13.3 AS GENERATOR REACHES NORMAL OUTPUT.

❻ ❼

UNDER NORMAL CONDITIONS, A 12V BATTERY IS FULLY CHARGED AT 12.8V. A SLIGHTLY HIGHER READING MAY OCCUR UNDER THE CONDITIONS OUTLINED IN NO. 5 BUT, GENERALLY SPEAKING, ANY READING ABOVE 12.8 WHEN THE ENGINE IS STOPPED IS NOT A TRUE READING.

NOTE: THE WORD "GENERATOR REFERS TO BOTH GENERATOR AND ALTERNATOR SINCE BOTH REQUIRE THE SAME INSTRUMENTATION

❻

THIS IS THE AREA IN WHICH THE POINTER SHOULD BE WHEN GENERATOR, VOLTAGE REGULATOR AND BATTERY ARE ALL IN GOOD CONDITION AND WORKING PROPERLY.

❼

WHEN THE POINTER GOES ABOVE 15.2, THE VOLTAGE REGULATOR IS SET TOO HIGH OR IS JAMMED AND CONTINUED OPERATION OF THE ENGINE WILL BURN OUT THE BATTERY

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Figure 2-37. Voltmeter indications.

Section IV. OPERATION UNDER USUAL CONDITIONS

2–15. General

a. The instructions in this section are published for the information and guidance of personnel responsible for operation of the Model M320T truck crane.

b. The operator must know how to perform every operation which can be performed with the Model M320T truck crane. This section gives instructions on starting and stopping the Model M320T truck crane, operation of the Model M320T truck crane, and on coordinating the basic motions required to perform the specific operations for which the equipment is designed. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual job.

2–16. Starting

a. Preparation for starting.

(1) Perform the preoperation services (para 2–1).

(2) Lubricate the truck crane as specified in current Lo.

(3) Open the engine rain shutters. Refer to figure 2–36.

b. Starting engine. Refer to figure 2–38 and start the crane engine.

c. Engine Warmup. Start the engine and bring it to a fast idle (approx 1,500 rpm) until normal operating temperature is reached, and the oil pressure gauge shows operating readings.

(1) At low temperatures, warmup time can be reduced by keeping doors and openings in the cab closed.

(2) Watch the engine oil pressure gauge closely. If the gauge does not indicate oil pressure within 15 seconds after starting the engine, stop the engine and report this condition to organizational maintenance.

2–17. Stopping

a. Refer to figure 2–39 and stop the engine.

b. Close rain shutters (fig. 2–36).

2–18. Starting the Crane

a. Start the engine (para 2–16).

b. Make certain that all operating clutches are disengaged and that all brakes are set. Engage the engine clutch, and listen for noisy operation.

c. Check the drum brakes by applying the brakes and engaging the drum clutches very slightly, pulling against the set brakes. Any slipping of the brakes will be felt and seen.

d. If possible lift a maximum load a few inches above the ground and make certain that it is held without drifting. See that adjustments are made, if necessary.

e. Release each drum brake in turn, and try the drum clutches for smooth engagement and responsive operation.

f. During an operational test, make a check for leaks from fuel and oil lines, and from the cooling system.

g. Check all housings for overheating. Prolonged use of brakes or clutches, in excess of normal operation, will cause overheating, lining wear, and damaged drums.

h. If there is evidence of equipment failure, report the condition to organizational maintenance.

2–19. Stopping the Crane

a. Place all control levers in the neutral position.

b. Make certain that the swing brake is set, and that the load or hook block has been lowered to the ground.

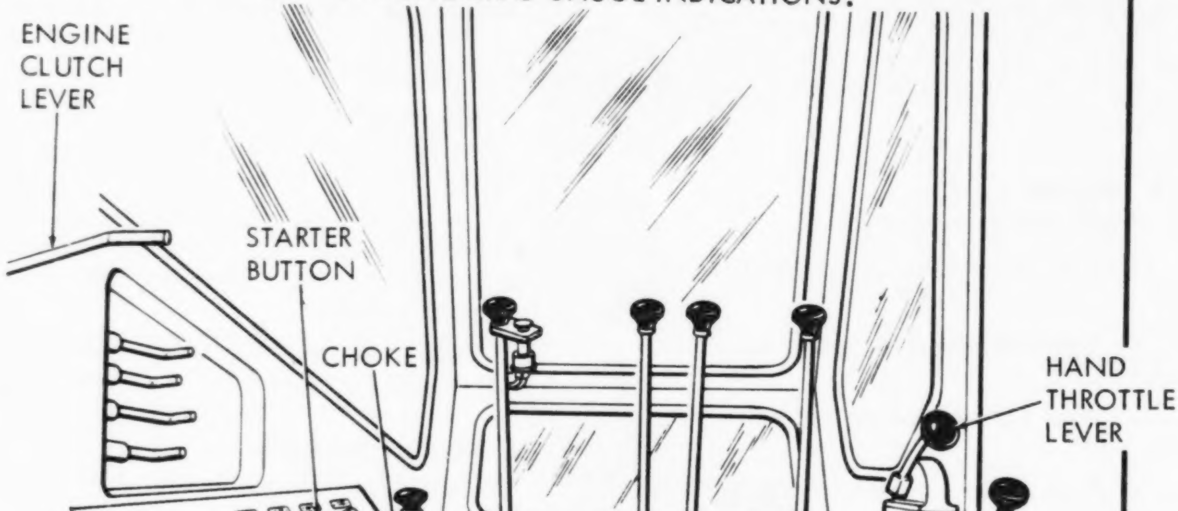
c. Close the hand throttle. If possible, allow the engine to run at half speed or less for several minutes before closing the throttle and stopping the engine. This will allow the engine to cool down and will prevent overheating due to localized residual heat.

d. Stop the engine (fig. 2–39).

2–20. Crane Operation

a. General. The Model M320T truck crane, with the crane boom installed and reeved for crane operation, is capable of accurate placement of a load at an elevation above or below the level of the crane cab.

b. Load Limits. Refer to paragraph 1–4 for load limits before starting operation.



STEP 1. PUSH ENGINE CLUTCH LEVER FORWARD TO DISENGAGE CLUTCH.
STEP 2. ADVANCE HAND THROTTLE LEVER HALFWAY.
STEP 3. USE CHOKE AS REQUIRED.
STEP 4. TURN IGNITION SWITCH ON.
STEP 5. DEPRESS STARTER BUTTON. RELEASE WHEN ENGINE STARTS.
CAUTION: DO NOT CRANK ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY WITHOUT ALLOWING A 2-MINUTE COOLING PERIOD. IF ENGINE DOES NOT START AFTER A FEW TRIES, STOP CRANKING. DETERMINE CAUSE AND CORRECT OR REPORT CONDITION TO ORGANIZATIONAL MAINTENANCE.
STEP 6. RETURN CHOKE TO OPEN POSITION. CHECK FOR WARNING LIGHT OR ABNORMAL GAUGE INDICATIONS.

ENGINE CLUTCH LEVER
STARTER BUTTON
CHOKE
HAND THROTTLE LEVER
IGNITION SWITCH
P&H
P&H
ME 3810-288-12/2-38

Figure 2-38. Starting crane engine.

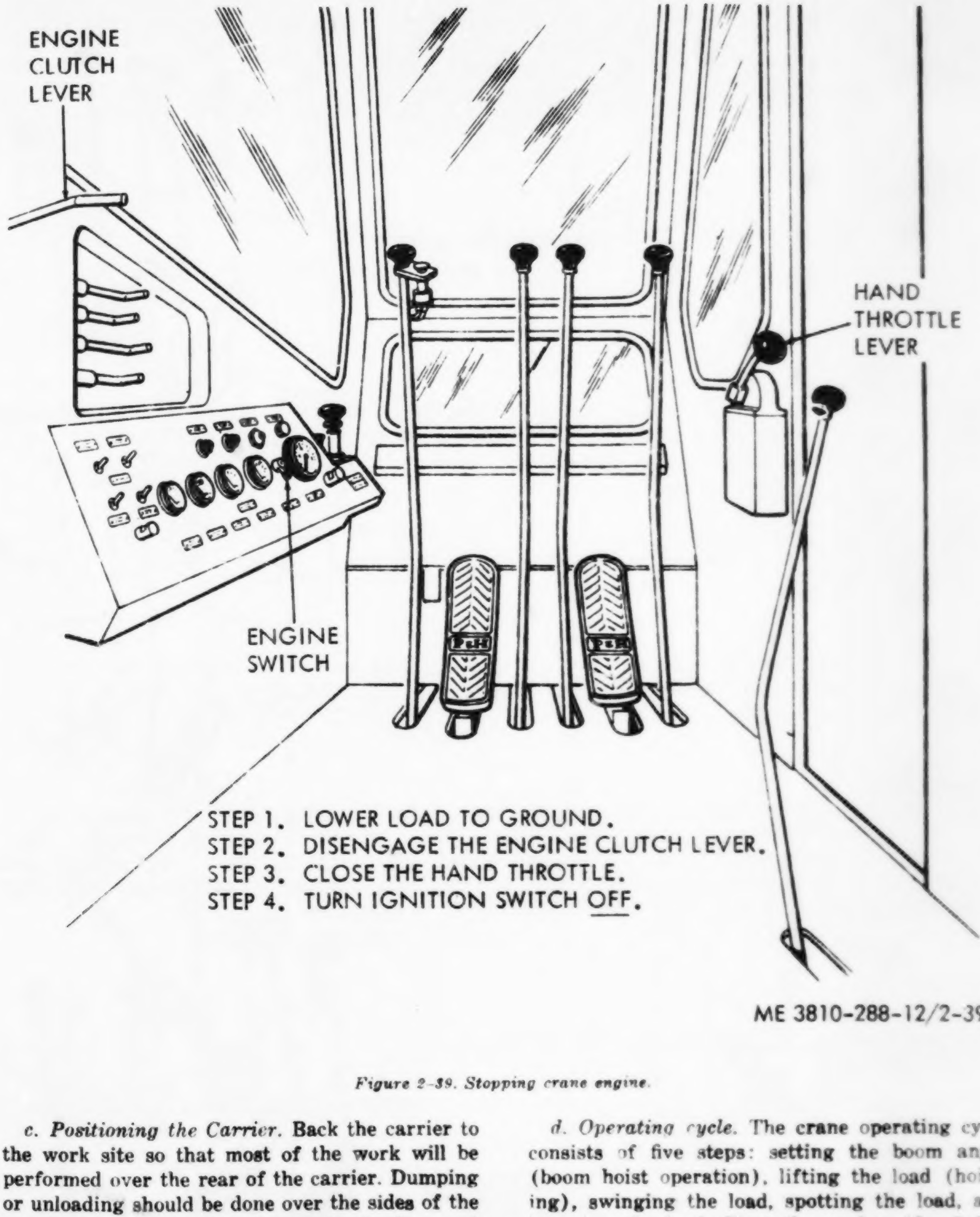

ENGINE CLUTCH LEVER
HAND THROTTLE LEVER
ENGINE SWITCH
P&H
P&H
STEP 1. LOWER LOAD TO GROUND.
STEP 2. DISENGAGE THE ENGINE CLUTCH LEVER.
STEP 3. CLOSE THE HAND THROTTLE.
STEP 4. TURN IGNITION SWITCH OFF.

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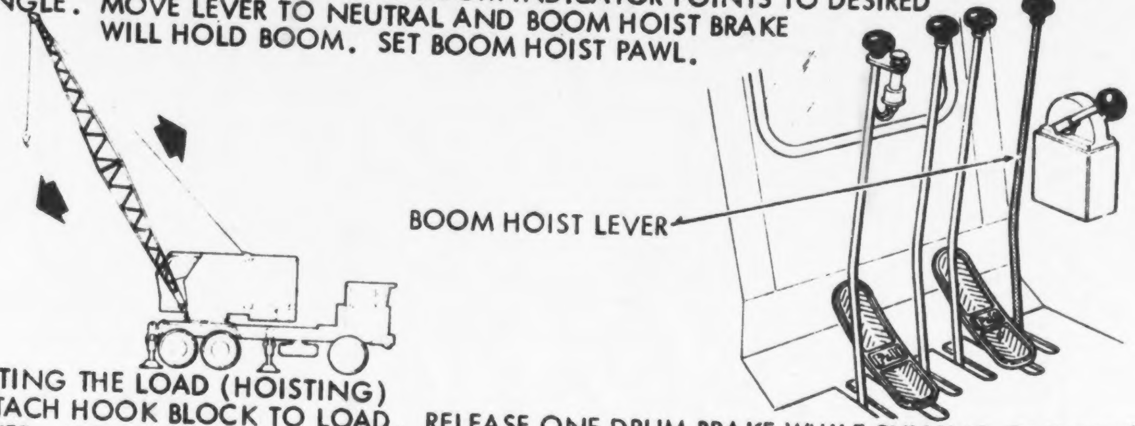
Figure 2-39. Stopping crane engine.

c. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Dumping or unloading should be done over the sides of the carrier, if possible. Set the carrier brakes, and extend and set the outriggers. Refer to figure 2-4.

d. Operating cycle. The crane operating cycle consists of five steps: setting the boom angle (boom hoist operation), lifting the load (hoisting), swinging the load, spotting the load, and lowering the load. Start the engine (fig. 2-38) and operate the crane as shown on figure 2-40.

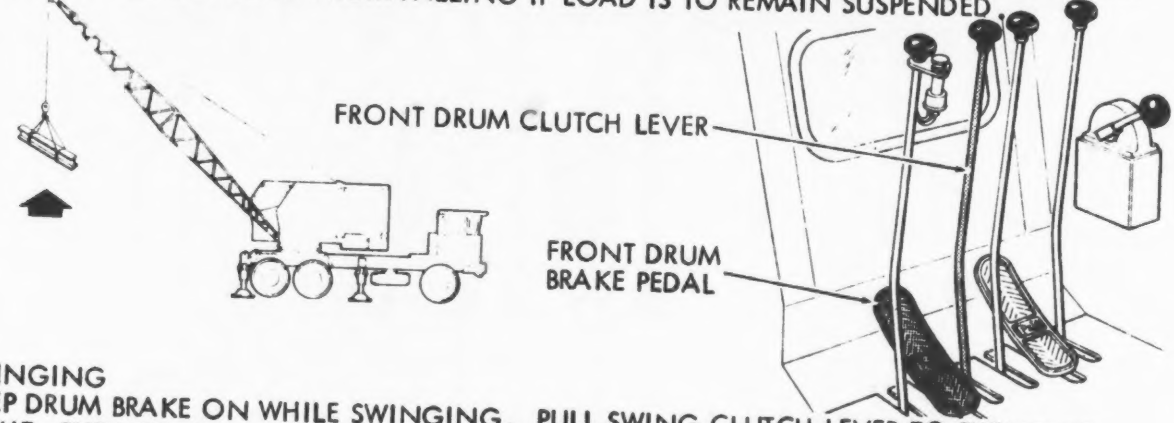
SETTING BOOM ANGLE

FOR HOISTING OPERATION WHEN CRANE BOOM IS USED, POSITION BOOM AT PROPER ANGLE FOR THE LOAD AND WORKING CONDITIONS. PULL BOOM HOIST LEVER TO RAISE OR PUSH TO LOWER UNTIL BOOM INDICATOR POINTS TO DESIRED ANGLE. MOVE LEVER TO NEUTRAL AND BOOM HOIST BRAKE WILL HOLD BOOM. SET BOOM HOIST PAWL.


BOOM HOIST LEVER

LIFTING THE LOAD (HOISTING)

ATTACH HOOK BLOCK TO LOAD. RELEASE ONE DRUM BRAKE WHILE PULLING ONE DRUM LEVER. HOIST TO DESIRED HEIGHT, APPLY BRAKE, AND MOVE LEVER TO NEUTRAL. SET PAWL TO PREVENT LOAD FROM FALLING IF LOAD IS TO REMAIN SUSPENDED.


FRONT DRUM CLUTCH LEVER
FRONT DRUM
BRAKE PEDAL

SWINGING

KEEP DRUM BRAKE ON WHILE SWINGING. PULL SWING CLUTCH LEVER TO SWING TO RIGHT, PUSH TO SWING TO LEFT. ENGAGE SLOWLY SO SWING WILL BE SMOOTH. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION GENTLY. SWINGING AND HOISTING CAN BE DONE SIMULTANEOUSLY. ENGAGE THE SWING BRAKE LEVER TO KEEP CAB FROM DRIFTING WHEN ACCURATE SPOTTING IS REQUIRED.

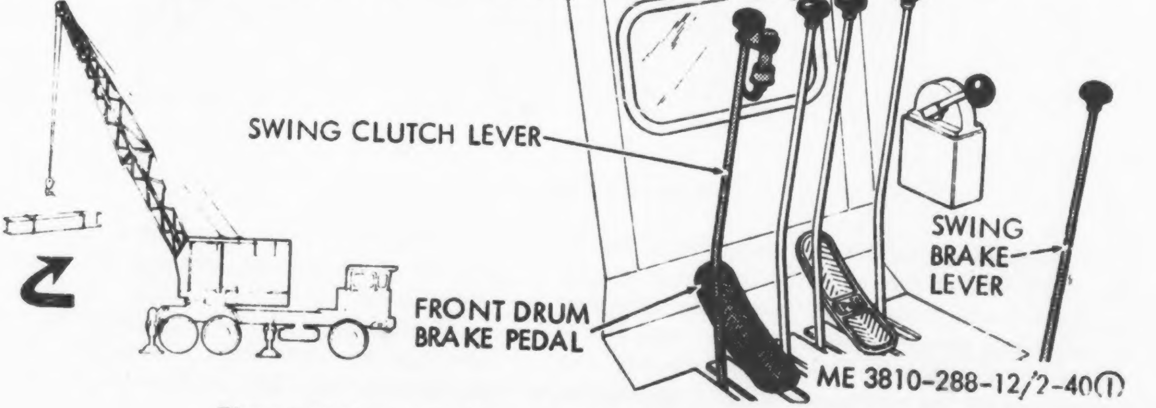
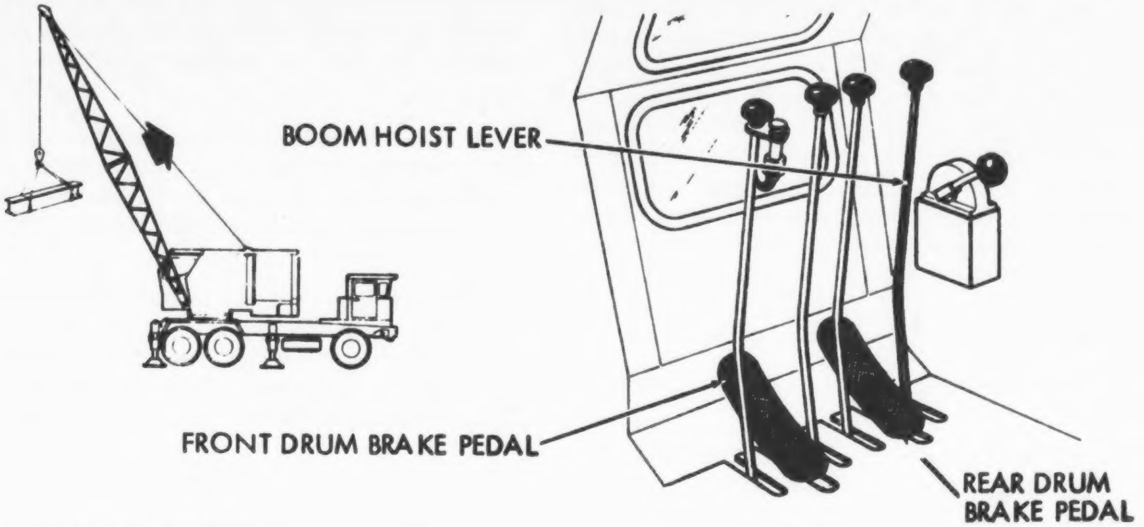

SWING CLUTCH LEVER
SWING
BRAKE
LEVER
FRONT DRUM
BRAKE PEDAL
ME 3810-288-12/2-40①

Figure 2-40. Crane operation and control positions. (Sheet 1 of 2)

SPOTTING THE LOAD

SPOTTING THE LOAD REQUIRES ACCURATE CONTROL OF HOIST AND SWING MOVEMENTS. IT TAKES PRACTICE TO LOCATE THE LOAD AT THE EXACT SPOT WITHOUT HUNTING OR OVERSHOOTING. RAISE OR LOWER THE BOOM WITH THE BOOM HOIST LEVER AS NECESSARY TO MAKE ACCURATE LOCATION OF LOAD. WARNING: NEVER BOOM OUT SO FAR THAT RATED LOAD IS EXCEEDED. SEE RATING PLATE.


BOOM HOIST LEVER
FRONT DRUM BRAKE PEDAL
REAR DRUM BRAKE PEDAL

LOWERING THE LOAD

THE LOAD CAN BE LOWERED IN TWO WAYS: RELEASE THE REAR DRUM BRAKE AND CONTROL LOWERING OF FREE FALLING LOAD WITH BRAKE AND REAR DRUM LEVER OR LOWER FRONT DRUM LOAD USING FRONT DRUM CLUTCH LEVER AND FRONT DRUM BRAKE PEDAL. THE LOAD WILL AUTOMATICALLY POWER DOWN.

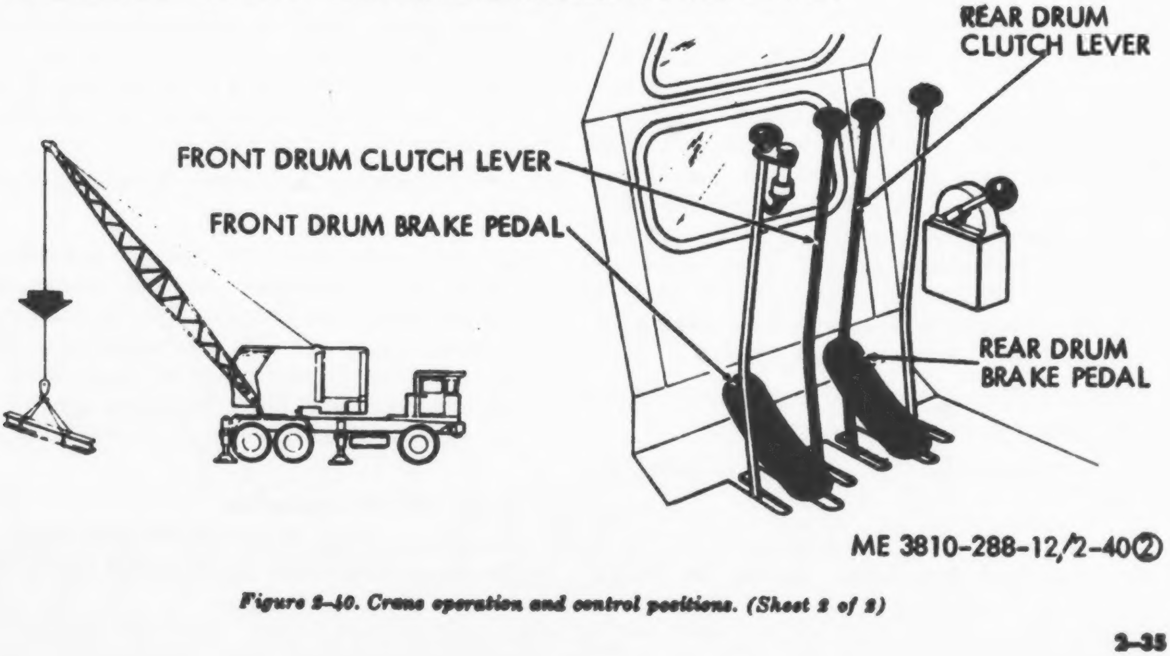

REAR DRUM CLUTCH LEVER
FRONT DRUM CLUTCH LEVER
FRONT DRUM BRAKE PEDAL
REAR DRUM BRAKE PEDAL

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Figure 2-40. Crane operation and control positions. (Sheet 2 of 2)

Caution: Do not attempt to raise the boom by means of the boom hoist lines if the boom tip is below the level of the ground which supports the carrier. The angle of pull on the boom will be such that the boom may collapse before it can be pulled into the operating position.

2-21. Clamshell Operation

a. General. The Model M320T truck crane, with the crane boom and a clam bucket installed and reeved for clamshell operation, is used to handle material which is relatively loose or soft and must be accurately dumped at a higher level than would be possible with a shovel attachment. The clamshell attachment is used widely for loading and unloading loose material from ships and open freight cars, and for digging deep pits or shafts where the digging point is accessible only to a vertically operated bucket.

b. Load Limits. Refer to paragraph 1-4 for load limits before starting operation.

c. Positioning the Carrier. Refer to paragraph 2-20.

d. Operating cycle. The clamshell operating cycle consists of four steps; filling the clam bucket (closing); raising the load bucket, swinging, and dumping. The boom angle position is set before beginning operations in the same manner as for the crane (fig. 2-40). Start the engine (para 2-16) and operate the clamshell as shown on figure 2-41.

2-22. Dragline Operation

a. General. The Model M320T truck crane, with the crane boom and a dragline bucket installed and reeved for dragline operation, is used to handle material which is soft, muddy, sticky, or medium hard, and where the loading and dumping points are far apart, both horizontally, and vertically, where digging is below machine grade, and where the material must be dumped accurately. The dragline attachment is used for digging canals, trenches, and levees, making embankments, and skimming of top soil.

b. Load Limits. Refer to paragraph 1-4 for load limits before starting operation.

c. Positioning the Carrier. Refer to paragraph 2-20.

d. Operating cycle. The dragline operating cycle consists of five steps: casting the bucket, dragging (filling) the bucket, raising the loaded bucket, swinging, and dumping. The boom angle position is set before beginning operations in the same manner as for the crane (fig. 2-40). Start the engine (para 2-16), and operate the dragline as shown on figure 2-42.

2-23. Piledriver Operation

a. General. The Model M320T truck crane, with the crane boom and a piledriver attachment installed and reeved for piledrive operation, is used for driving piles for bridges, piers, and foundations.

b. Positioning the Carrier. Back the carrier to the work site so that most of the work will be performed over the rear of the carrier. Set the carrier brakes, and extend and set the outriggers (fig. 2-4).

c. Operating cycle. The piledriver operating cycle consists of four steps: positioning the piledriver, setting the pile, lifting the hammer, and dropping the hammer. Start the engine (para 2-16), and operate the piledriver as shown on figure 2-43.

2-24. Backhoe Operation

a. General. The Model M320T truck crane, with the backhoe attachment installed and reeved as described in paragraph 2-9, is used where the digging level is below machine grade, the area to be worked is relatively small, requires the movement of a minimum amount of material, and the material must be dumped accurately. The backhoe attachment is used in preference to the dragline attachment when precise control is required, and when it is required that the walls of the excavation be straight.

b. Positioning the Carrier. Refer to paragraph 2-20.

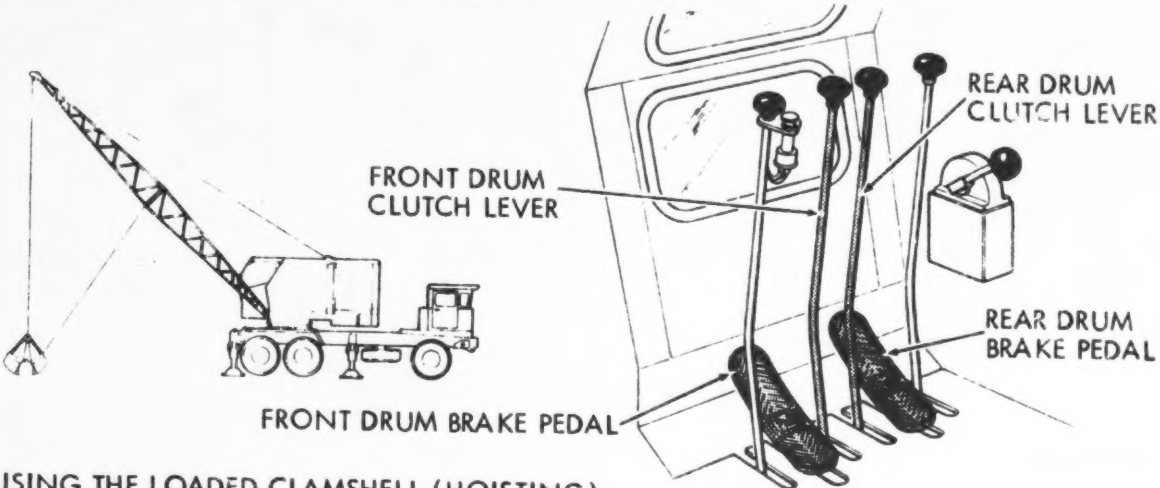
c. Operating cycle. The backhoe operating cycle consists of four steps: filling the dipper, hoisting, swinging, and dumping. During backhoe operation, tension must be maintained in both the front and rear drum lines at all times, since they are interdependent. Start the engine (para 2-16), and operate the backhoe as shown on figure 2-44.

2-25. Shovel Operation

a. General. The Model M320T truck crane, with the shovel attachment installed and reeved as de-

FILLING THE CLAMSHELL (CLOSING)

LOWER THE OPENED CLAMSHELL UNTIL IT IS A FOOT ABOVE MATERIAL TO BE WORKED. RELEASE BOTH BRAKE PEDALS SIMULTANEOUSLY AND DROP THE CLAMSHELL. CLOSE CLAMSHELL BY PULLING REAR DRUM CLUTCH LEVER. AT THE SAME TIME CONTROL DIGGING DEPTH OF CLAMSHELL WITH FRONT DRUM CLUTCH LEVER UNTIL IT IS CLOSED AND LOADED. TO DECREASE BITE OF CLAMSHELL, PULL FRONT DRUM CLUTCH LEVER. THIS WILL RAISE THE BUCKET AND DECREASE THE BITE.


REAR DRUM CLUTCH LEVER
FRONT DRUM CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

RAISING THE LOADED CLAMSHELL (HOISTING)

KEEP THE REAR DRUM CLUTCH LEVER PULLED BACK AND OPERATE THE FRONT DRUM CLUTCH LEVER SO CABLES ARE TAKEN UP AT THE SAME RATE. THE CLOSING CABLE IS THE MOST IMPORTANT AND DOES MOST OF THE WORK. NEVER ALLOW IT TO GO SLACK OR CLAMSHELL WILL IMMEDIATELY SWING OPEN. DO NOT USE HOLDING CABLE TO RAISE THE CLAMSHELL; THE HOLDING CABLE IS USED ONLY TO HOLD THE BUCKET IN POSITION WHEN DUMPING. AS SOON AS BUCKET IS AT DESIRED HEIGHT, APPLY BOTH FRONT AND REAR DRUM BRAKE PEDALS AND AT THE SAME TIME RELEASE BOTH THE FRONT AND REAR DRUM CLUTCH LEVERS.

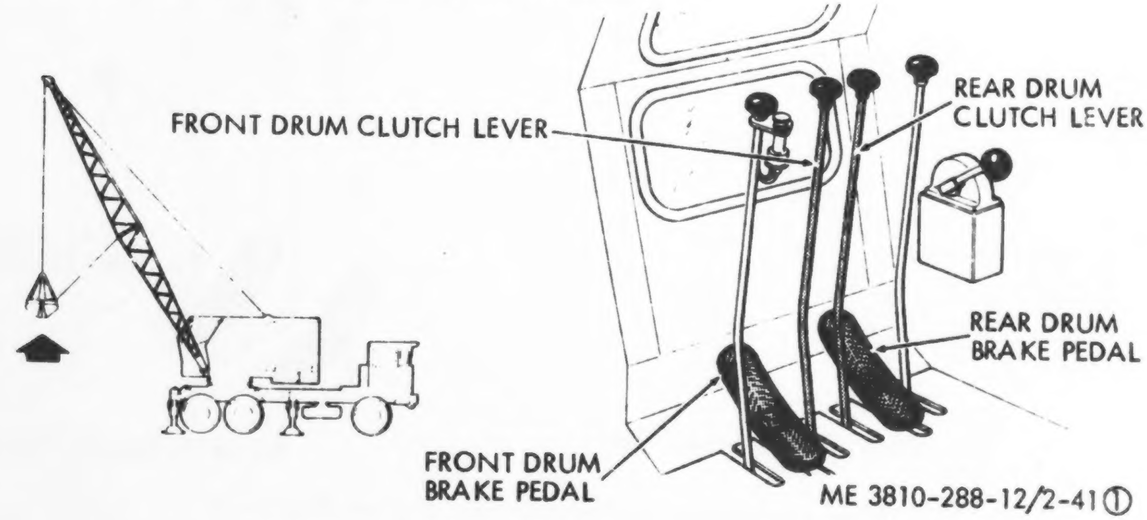
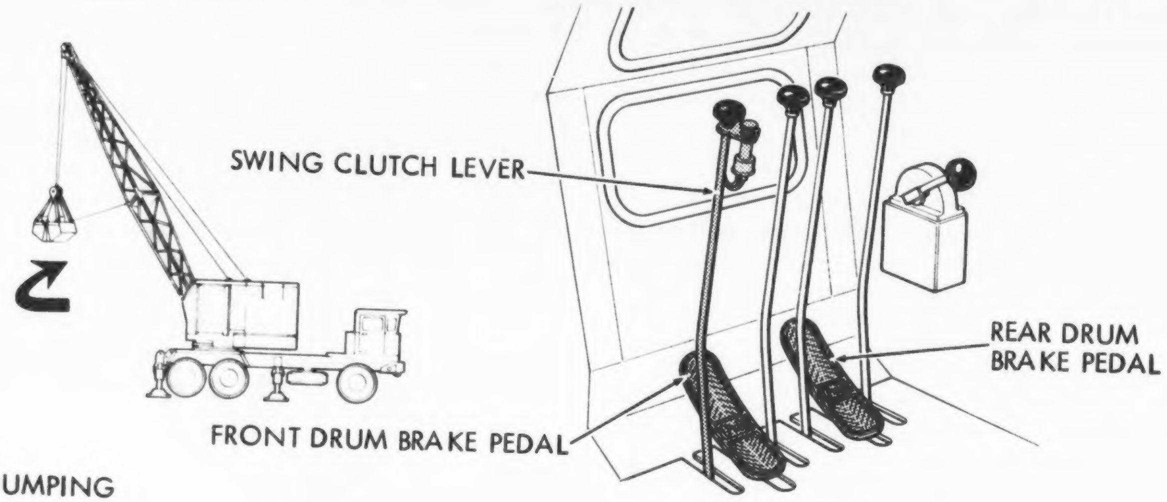

REAR DRUM CLUTCH LEVER
FRONT DRUM CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL
ME 3810-288-12/2-41①

Figure 2-41. Clamshell operation and control positions. (Sheet 1 of 2)

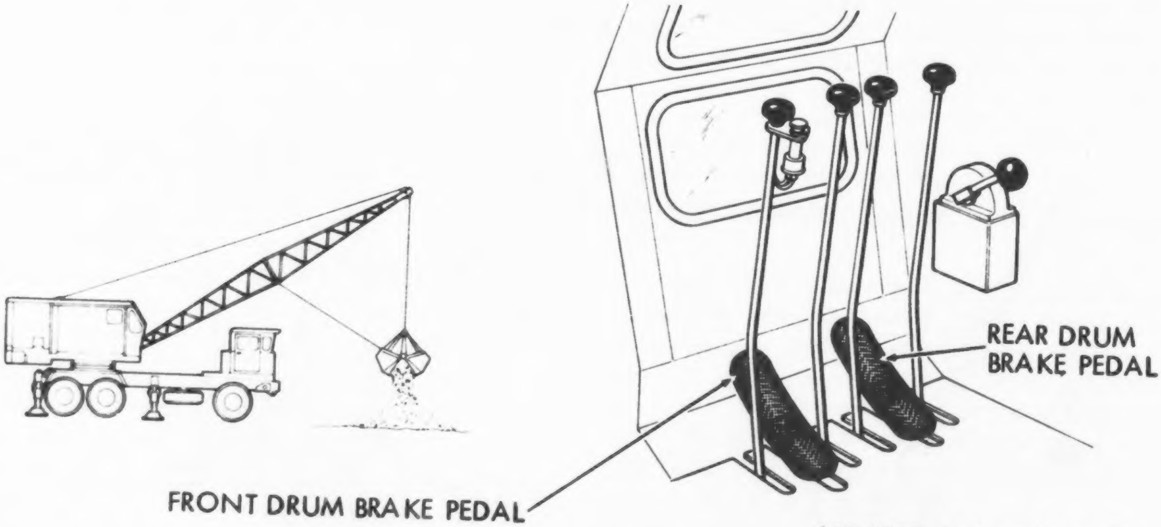
SWINGING

KEEP BOTH THE FRONT AND REAR DRUM BRAKES ON WHILE SWINGING. PULL SWING CLUTCH LEVER TO SWING TO RIGHT, PUSH TO SWING TO LEFT. ENGAGE SLOWLY SO SWING IS SMOOTH. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION GENTLY. SWINGING AND HOISTING CAN BE DONE SIMULTANEOUSLY AS SOON AS BUCKET IS HIGH ENOUGH TO CLEAR ALL INTERVENING OBSTACLES.


SWING CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

DUMPING

KEEP THE FRONT DRUM BRAKE PEDAL FIRMLY DEPRESSED AND AT THE SAME TIME RELEASE THE REAR DRUM BRAKE PEDAL. DEPRESS THE REAR DRUM BRAKE PEDAL AND STOP THE CABLE BEFORE THE BUCKET HALVES OPEN SO FAR THAT THEY SLAM AGAINST THE STOPS. AFTER CLAMSHELL UNLOADS, SWING THE CRANE WITH CLAMSHELL OPEN BACK TO MATERIAL PILE. WHEN OVER THE WORKING AREA, LOWER THE OPEN BUCKET AND REPEAT THE WORKING CYCLE.


REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

ME 3810-288-12/2-41②

Figure 2-41. Clamshell operation and control positions. (Sheet 2 of 2)

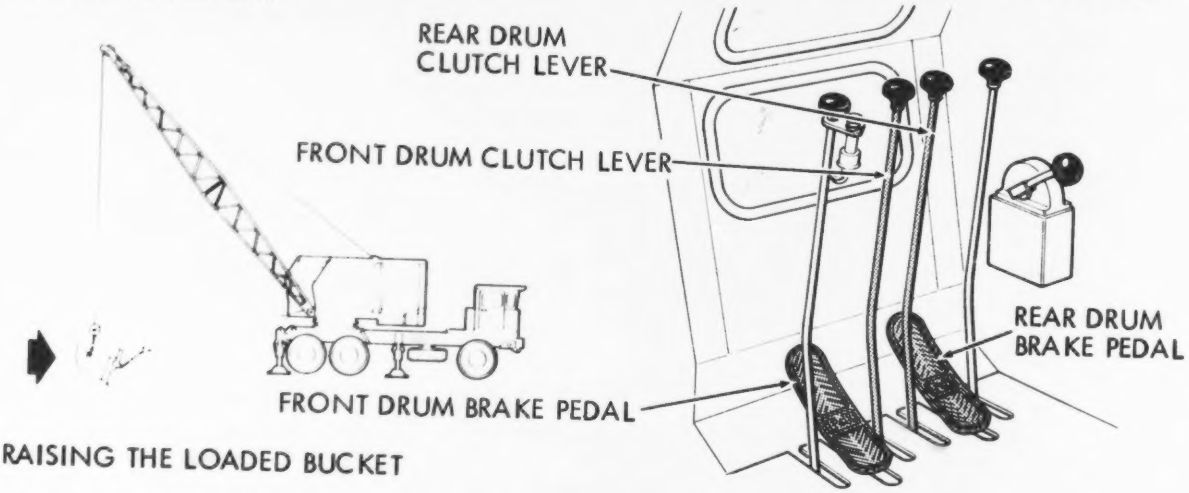
scribed in paragraph 2-10, is used where the material being dug is firm or hard, the digging and dumping points are not too far apart, accurate dumping is required, and the dumping point is at the same level as the machine. The shovel is used most efficiently when the area being worked is large enough to allow operation approaching the maximum working ranges of the shovel attachment.

b. Positioning the Carrier. Refer to paragraph 2-20.

c. Operating cycle. The shovel operating cycle consists of four steps: filling the dipper, swinging, spotting the dump, and dumping. The shovel boom angle position is set before beginning operations in the same manner as for the crane (fig. 2-40). Start the engine (para 2-16) and operate the shovel as shown on figure 2-45.

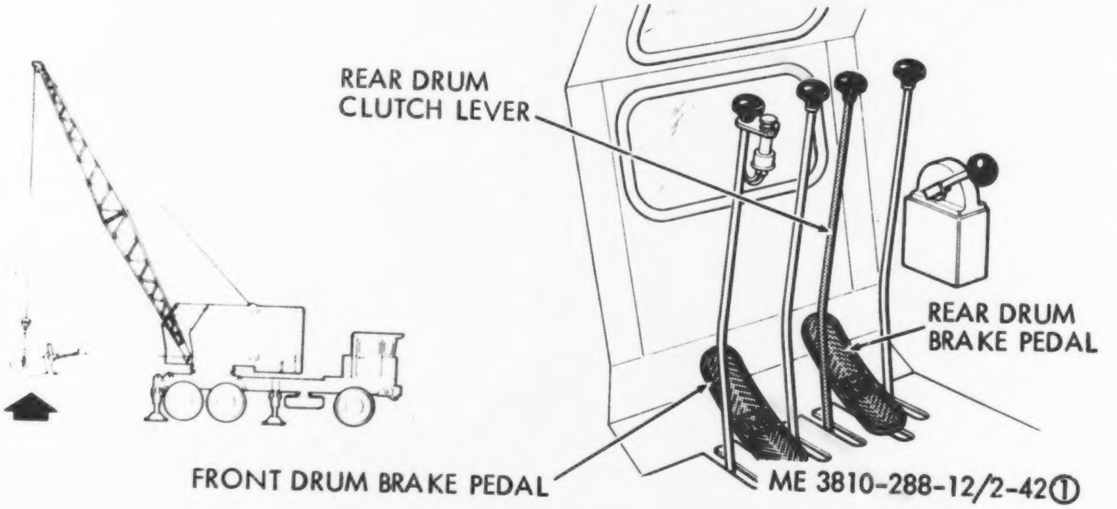
CASTING AND FILLING THE DRAGLINE BUCKET

CASTING THE BUCKET ADDS 10 TO 20 FEET TO THE EFFECTIVE DIGGING RADIUS. PULL THE FRONT DRUM LEVER AND RAISE THE BUCKET HALF THE DISTANCE BETWEEN THE GROUND AND THE BOOM POINT. DEPRESS REAR DRUM BRAKE AND RELEASE THE LEVER. PULL FRONT DRUM LEVER AND PULL BUCKET IN TOWARD THE BOOM, THEN SIMULTANEOUSLY RELEASE LEVER AND BRAKE PEDAL ALLOWING BUCKET TO CAST OUT BEYOND THE BOOM POINT. ACCURATE CASTING WILL COME ONLY WITH PRACTICE. AFTER THE BUCKET HAS BEEN CAST, PULL THE FRONT DRUM LEVER BACK, DRAGGING THE BUCKET TOWARD THE MACHINE. EASE UP ON THE REAR DRUM BRAKE PEDAL ALLOWING THE HOIST CABLE TO REEL OFF THE DRUM SO THE BUCKET TEETH CONTINUOUSLY BITE INTO THE GROUND. WHEN BUCKET IS FULL, RELEASE THE FRONT DRUM LEVER AND DEPRESS BOTH BRAKE PEDALS.


REAR DRUM CLUTCH LEVER
FRONT DRUM CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

RAISING THE LOADED BUCKET

PULL THE REAR DRUM LEVER BACK AND RELEASE THE REAR DRUM BRAKE PEDAL. EASE UP ON THE FRONT DRUM BRAKE PEDAL TO HOLD THE BUCKET LEVEL AND PREVENT DUMPING AS THE BUCKET IS RAISED. WHEN BUCKET REACHES DESIRED HEIGHT, APPLY REAR DRUM BRAKE AND RELEASE THE REAR DRUM LEVER. ALSO, APPLY FRONT DRUM BRAKE.

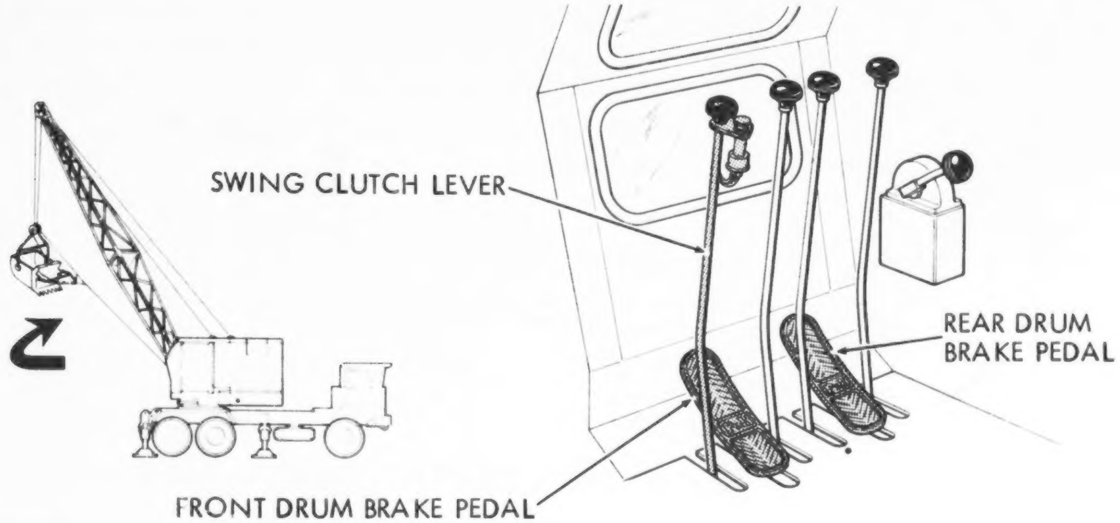

REAR DRUM CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

ME 3810-288-12/2-42①

Figure 2-42. Dragline operation and control positions. (Sheet 1 of 2)

SWINGING

KEEP BOTH THE FRONT AND REAR DRUM BRAKES ON WHILE SWINGING. PULL THE SWING CLUTCH LEVER TO SWING TO RIGHT, PUSH TO SWING TO LEFT. ENGAGE SLOWLY SO SWING IS SMOOTH. TO STOP SWING, ENGAGE LEVER IN OPPOSITE SWING POSITION. GENTLY SWING THE BUCKET TOWARD THE DUMP PILE.


SWING CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

DUMPING

AS THE DUMP PILE IS APPROACHED, RELEASE THE FRONT DRUM BRAKE PEDAL ALLOWING THE BUCKET TO SWING OUT AND DUMP ITS LOAD. WHEN THE BUCKET IS DUMPED, APPLY THE FRONT DRUM BRAKE TO KEEP THE CABLE TAUT AND PREVENT UNWINDING. SWING THE BOOM BACK, CAST THE DRAGLINE BUCKET AND REPEAT THE CYCLE.

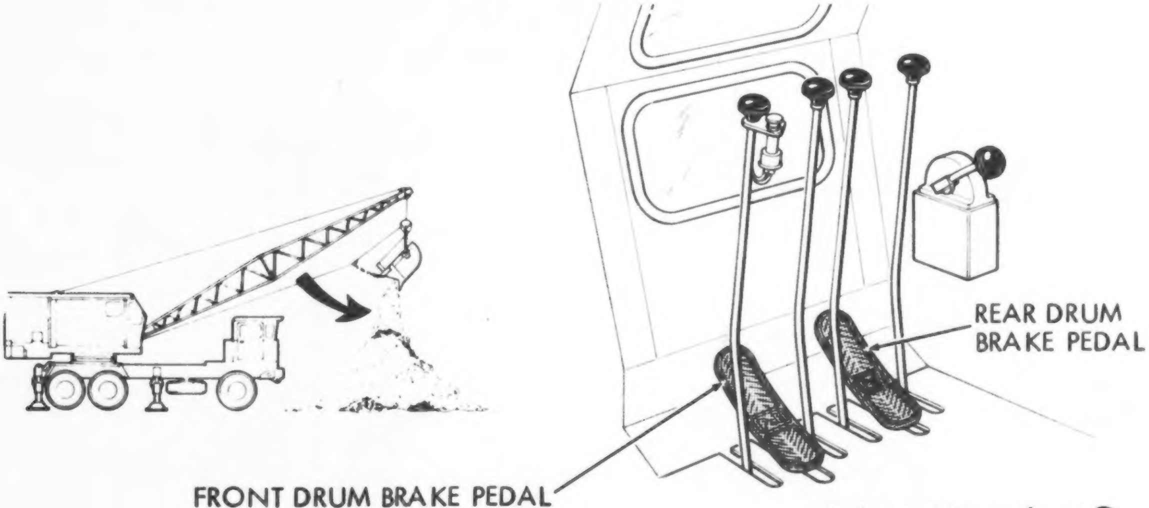
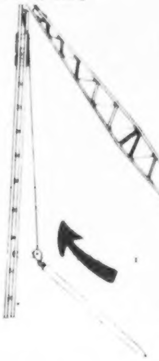
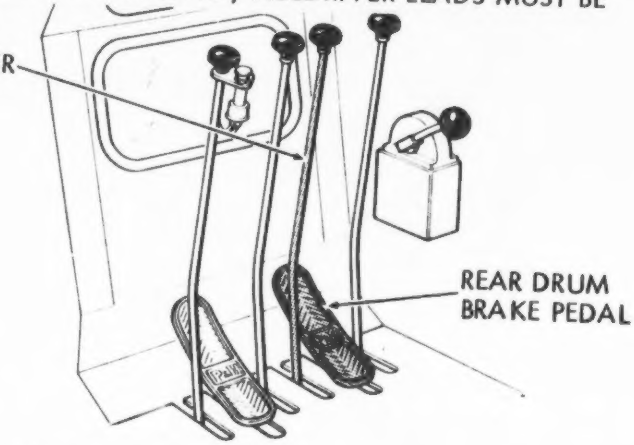

REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL
ME 3810-288-12/2-42②

Figure 2-42. Dragline operation and control positions. (Sheet 2 of 2)

POSITIONING THE PILEDRIVER

HOOK THE PILE CAP SLINGS IN THE HAMMER LUGS. PULL THE REAR DRUM LEVER BACK TO RAISE THE HAMMER AND PILE CAP IN THE LEADS. APPLY THE REAR DRUM BRAKE PEDAL AND RELEASE THE REAR DRUM LEVER. MOVE THE CARRIER SLOWLY TO POSITION THE PILEDRIVER. WHEN MOVING WATCH THAT THE LEADS DO NOT BOTTOM ON THE GROUND. MAKE SURE BOOM IS CLEAR OF POWER LINES OR OVERHEAD OBSTRUCTIONS. FOR INCREASED STABILITY KEEP THE HAMMER AND CAP LOW IN THE LEADS WHILE MOVING. POSITION THE PILEDRIVER WITH THE LEADS OFF THE REAR OF THE CARRIER. SET THE LEADS IN FINAL POSITION BY BACKING CARRIER AND SWINGING CRANE LEFT OR RIGHT AS REQUIRED. BEFORE OPERATING, PILEDRIVER LEADS MUST BE VERTICAL.





SETTING THE PILE

RAISE THE HAMMER AND PILE CAP TO THE TOP OF THE LEADS, THEN LOCK THE REAR DRUM BRAKE PEDAL. ATTACH THE PILE HOIST CABLE HOOK (ON THE FRONT DRUM) TO THE TOP OF THE PILE. DRAG THE PILE UP INTO THE LEADS BY PULLING BACK ON THE FRONT DRUM LEVER. WHEN THE PILE IS VERTICAL IN THE LEADS, LOWER THE HAMMER AND CAP, GUIDING THE TOP OF THE PILE INTO THE HOLLOW IN THE BOTTOM OF THE PILE CAP. SET THE POINT OF THE PILE IN PLACE ON THE GROUND AND REST THE HAMMER AND CAP ON TOP OF THE PILE. DROP THE SLING HOLDING THE PILE CAP TO THE HAMMER. BE SURE THE PILE IS VERTICAL. DISCONNECT THE PILE HOIST CABLE. STORE THE CABLE FOR EASY ACCESS. THE PILE WILL BE HELD IN POSITION BY THE PILE CAP.

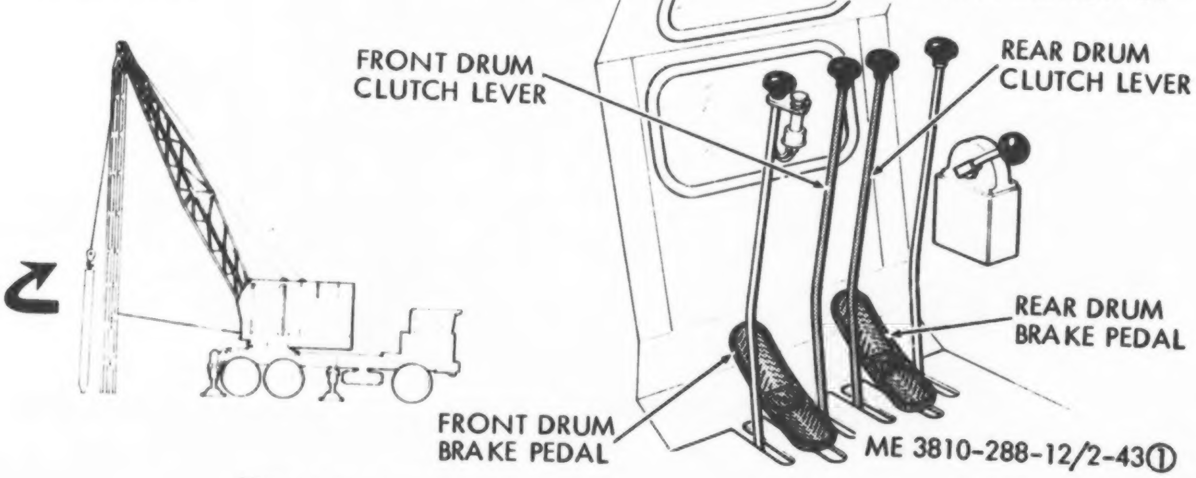
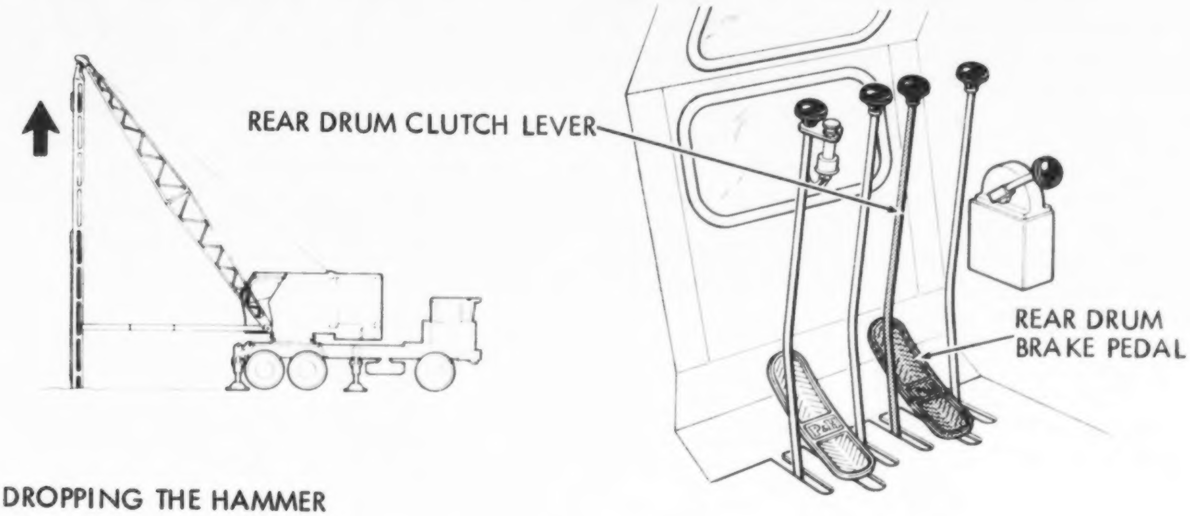


Figure 2-43. Piledriver operation and control positions. (Sheet 1 of 2)

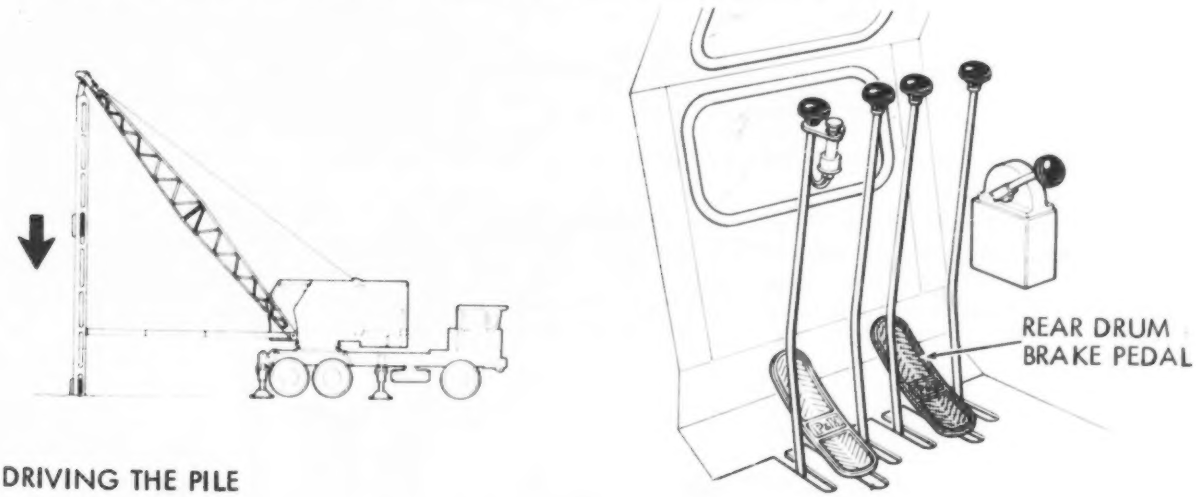
LIFTING THE HAMMER

PULL THE REAR DRUM LEVER BACK TO RAISE THE HAMMER. APPLY THE REAR DRUM BRAKE PEDAL AND RELEASE THE REAR DRUM LEVER WHEN HAMMER REACHES DESIRED HEIGHT.



DROPPING THE HAMMER

RELEASE THE REAR DRUM BRAKE PEDAL TO DROP THE HAMMER.



DRIVING THE PILE

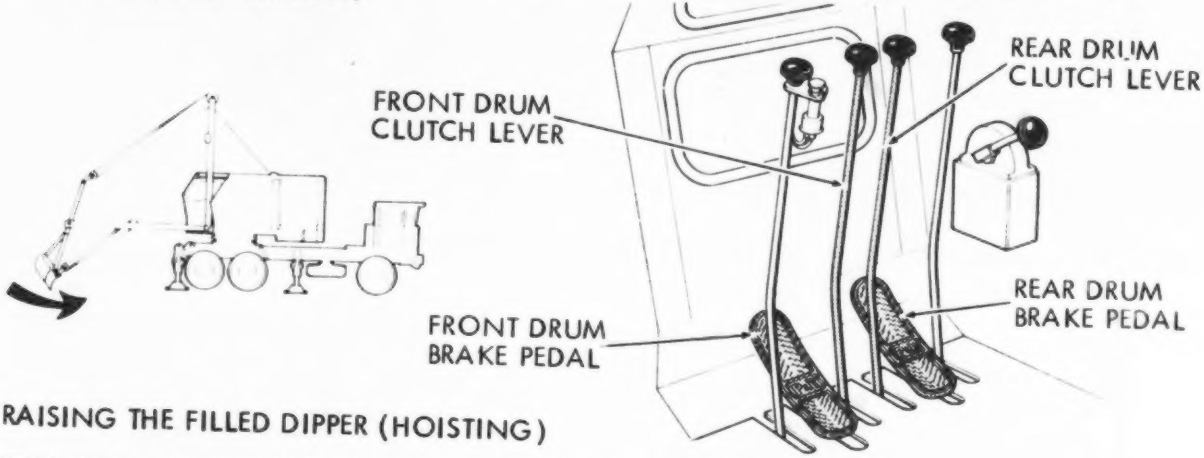
LIFT THE HAMMER A SHORT DISTANCE AND DROP THE HAMMER. JUST AS THE HAMMER REACHES THE WOODEN PILE CAP PLUG, STEP ON THE REAR DRUM BRAKE PEDAL TO KEEP THE HOIST CABLE FROM UNREELING. MAKE THE FIRST SERIES OF BLOWS ON THE PILE LIGHT ONES SO THE PILE WILL BE STARTED INTO THE GROUND EVENLY. CHECK THAT THE PILE IS STRAIGHT. IF THE PILE IS ANGLED, AND NOT TOO DEEP, MOVE THE CRANE TO STRAIGHTEN IT. AFTER THE PILE IS STARTED, RAISE THE HAMMER TO THE TOP OF THE LEADS, DROP IT AND APPLY THE REAR DRUM BRAKE AS INSTRUCTED ABOVE. REPEAT THE ACTION UNTIL THE PILE IS DRIVEN TO THE DESIRED DEPTH. SLING THE PILE CAP TO THE HAMMER, RAISE THE HAMMER, POSITION THE PILEDRIVER OVER THE NEXT PILE SITE, AND REPEAT THE CYCLE.

ME 3810-288-12/2-43②

Figure 2-43. Piledriver operation and control positions. (Sheet 2 of 2)

FILLING THE BACKHOE DIPPER

PUSH FORWARD ON THE FRONT DRUM LEVER, ALLOWING DRAG CABLE TO PLAY OUT AS THE DIPPER SWINGS OUT. PULL REAR DRUM LEVER TO TAKE UP SLACK IN THE HOIST LINE AND TO PREVENT THE BOOM FROM DROPPING. WHEN THE DIPPER IS EXTENDED FULLY, PUSH THE REAR DRUM LEVER FORWARD AND RELEASE THE REAR DRUM BRAKE PEDAL, GRADUALLY ALLOWING THE BOOM AND DIPPER TO LOWER AND BITE INTO THE GROUND. STEP ON THE REAR DRUM BRAKE PEDAL AND PULL THE FRONT DRUM LEVER BACK TO START DRAGGING THE DIPPER IN TOWARD THE MACHINE. CONTROL THE DEPTH OF THE BITE WITH THE REAR DRUM BRAKE PEDAL. EASING UP ON PEDAL WILL DROP THE DIPPER FOR A BIGGER BITE. HOLDING IT WILL CAUSE DIPPER TO RISE. PRACTICE THE INTERCONTROL OF THE HOIST AND DRAG CABLE BRAKES AND LEVERS TO BECOME FAMILIAR WITH THEIR OPERATION. WHEN THE DIPPER IS FULL, APPLY BOTH BRAKES AND PUSH THE FRONT DRUM LEVER FORWARD (TO NEUTRAL) TO STOP THE DRAGGING ACTION.


REAR DRUM CLUTCH LEVER
FRONT DRUM CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

RAISING THE FILLED DIPPER (HOISTING)

PULL THE REAR DRUM LEVER BACK AND RELEASE THE REAR DRUM BRAKE PEDAL. AS THE BOOM IS RAISED, EASE UP SLIGHTLY ON THE FRONT DRUM BRAKE PEDAL, BUT KEEP ENOUGH TENSION IN THE DRAG CABLE TO HOLD THE DIPPER LEVEL UNDER THE BOOM. WHEN THE DIPPER IS RAISED HIGH ENOUGH TO CLEAR THE EXCAVATION, PUSH THE REAR DRUM LEVER FORWARD TO NEUTRAL AND SIMULTANEOUSLY DEPRESS THE REAR DRUM BRAKE.

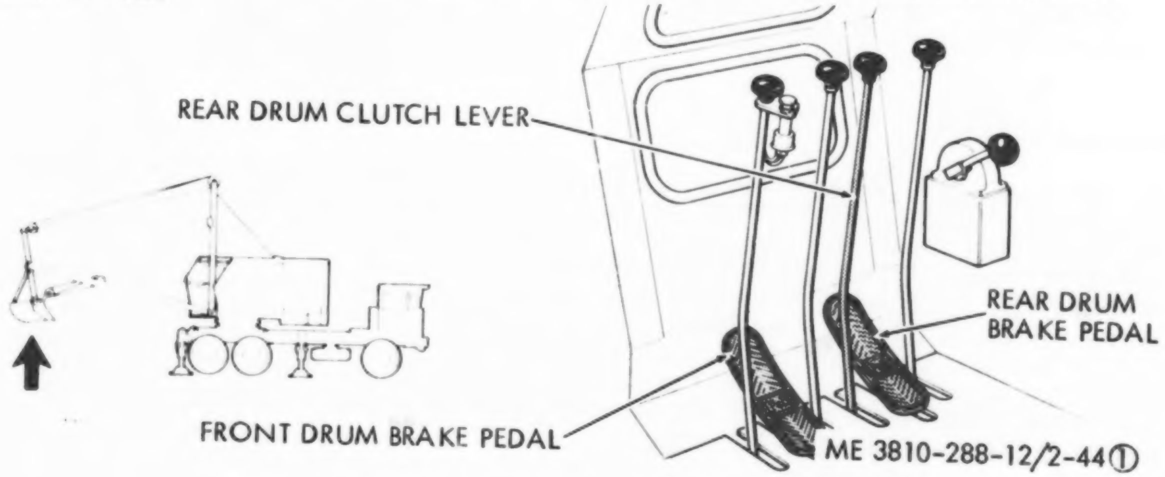
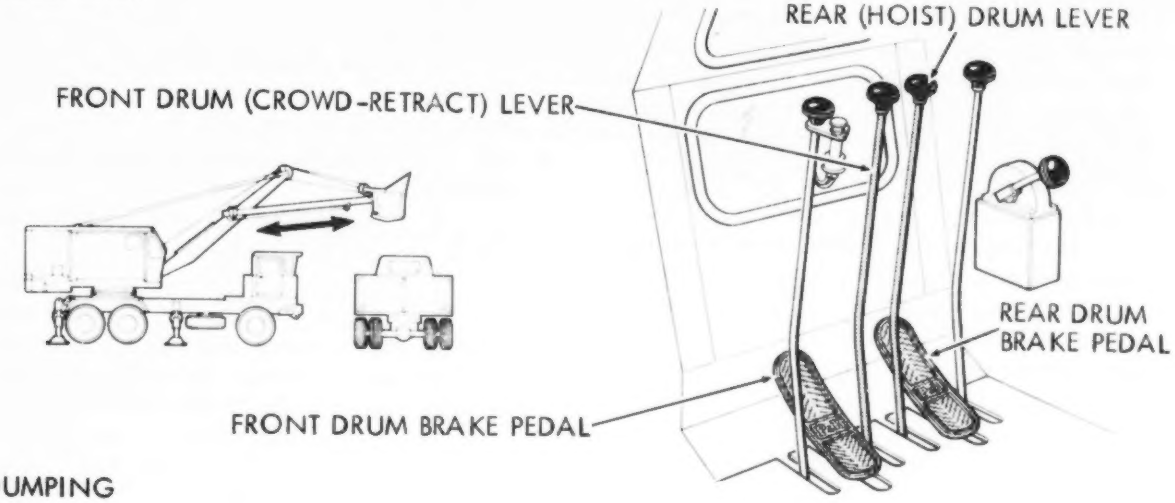

REAR DRUM CLUTCH LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL
ME 3810-288-12/2-44①

Figure 2-44. Backhoe operation and control positions. (Sheet 1 of 2)

SPOTTING THE DUMP

AS THE LOADED DIPPER IS SWINGING, CROWD OR RETRACT THE DIPPER STICK SO THE DIPPER DOOR WILL BE DIRECTLY OVER THE DUMPING POINT WHEN THE SWING IS COMPLETED. HOIST THE DIPPER, IF NECESSARY, TO RAISE IT TO THE PROPER HEIGHT FOR DUMPING. WHEN DUMPING INTO TRUCKS, SPOT THE TRUCKS SO THE LOAD WILL SWING OVER THE TAILGATE OF THE TRUCK. NEVER SWING THE LOAD OVER THE TRUCK CAB.


REAR (HOIST) DRUM LEVER
FRONT DRUM (CROWD-RETRACT) LEVER
REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL

DUMPING

AFTER DUMP IS SPOTTED, DEPRESS THE DIPPER TRIP SWITCH ON THE SWING CLUTCH LEVER. HOIST THE DIPPER SLIGHTLY TO RAISE IT CLEAR OF THE FLOWING MATERIAL AND TO OPEN THE DIPPER DOOR COMPLETELY. HOIST HIGH ENOUGH THAT DOOR CLEARS ALL OBSTRUCTIONS. START SWINGING THE EMPTY DIPPER BACK TOWARD THE CUT BEING WORKED. LOWER THE DIPPER BY RELEASING THE REAR DRUM BRAKE PEDAL. THE DIPPER DOOR WILL SNAP SHUT WHEN THE DIPPER IS LOWERED. RETRACT THE DIPPER AND HAVE IT IN POSITION FOR THE NEXT PASS WHEN THE SWING IS COMPLETED. REPEAT THE CYCLE.

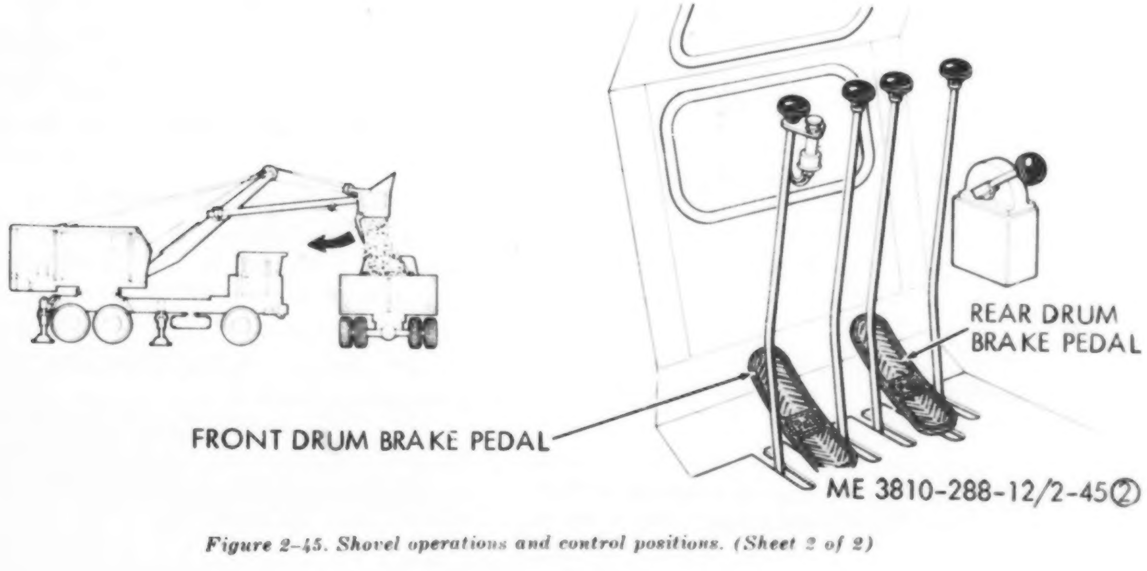

REAR DRUM BRAKE PEDAL
FRONT DRUM BRAKE PEDAL
ME 3810-288-12/2-45②

Figure 2-45. Shovel operations and control positions. (Sheet 2 of 2)

Section V. OPERATION UNDER UNUSUAL CONDITIONS

2-26. Operation in Extreme Cold (Below 0° F.)

a. General. Operation in extreme cold presents special problems due to the increased brittleness of metallic and rubber parts, the danger of freezing, and the increased difficulty of keeping parts lubricated adequately.

***Warning:* Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful injury may result.**

b. Lubrication.

(1) Refer to the lubrication order for special lubricants to be used at various temperatures.

(2) When using OES oil in the crankcase, the oil level must be checked frequently, as oil consumption may increase.

c. Cooling System.

(1) Drain and flush the cooling system, to insure proper circulation of coolant throughout the radiator core. Clean the radiator cooling fins, particularly the air passages through the core.

(2) Inspect the cooling system for leaks. Replace worn or damaged hose connections. Tighten the hose clamps.

(3) Fill the cooling system with the proper amount and mixture of ethylene-glycol type antifreeze.

(4) After filling the cooling system, run the engine to mix the antifreeze solution thoroughly.

d. Batteries.

(1) Keep the batteries fully charged at all times. The electrolyte in a discharged battery will freeze at a higher temperature than that in a fully charged battery.

(2) If the batteries require water, add only before or during operation, or charge the batteries from an outside source. Charging the batteries will mix the water and the electrolyte, and prevent them from freezing.

(3) Keep the battery terminal connections clean and free from snow or ice accumulations, which may short circuit the batteries externally, causing them to discharge.

(4) In extremely low temperatures, remove the batteries and place them in a heated shelter when not in use. The current output from a warm battery will be higher than that from a cold battery.

e. Fuel System. Keep the fuel tank as full as possible at all times to minimize condensation. If the presence of water is noted in the fuel supply, drain the tank and refill it with clean fuel. Refer to figure 3-7.

f. Starting.

(1) At very low temperatures, provide heat in the cab for as long as possible before attempting to start the engine.

***Warning:* Do not use an open flame as the source of heat.**

(2) Crank the engine with the ignition off to free the pistons and bearings.

(3) Lift the choke knob to provide the richest fuel mixture possible. Use the cold weather starting aid to pump about three shots of fuel into the engine intake manifold. Advance the throttle control to its middle position.

(4) Turn on the ignition switch and start the engine. If the engine does not start, determine whether the fuel line is frozen.

g. Warmup. Cover part of the air passages through the radiator, to aid warmup and to maintain engine running temperature. During warmup only, the entire radiator may be covered.

h. Stopping. Set all dippers, buckets, or loads on blocks to keep them from freezing to the ground, leaving just enough tension in the cables to keep them taut. Set all drum pawls, and release the clutches and brakes. Turn off the engine ignition. Close all cab openings securely.

i. Operation on Snow or Ice. Take all necessary precautions to insure a firm footing for the truck crane. Extend the outriggers (para. 2-3) using blocking under the jackfloats to obtain firm footing.

2-27. Operation in Extreme Heat

a. General. Operation in extreme heat presents special problems due to the difficulty in keeping the engine from overheating.

b. Lubrication.

(1) Refer to the lubrication order for specia lubricants to be used.

(2) Make certain that the engine crankcase oil is at the proper level. An inadequate suppl of crankcase oil will prevent proper dissipatio of heat from the engine.

c. Cooling System.

(1) Drain and flush the cooling system, to insure proper circulation of coolant throughout the radiator core. Clean the radiator cooling fins, particularly the air passages through the core, of insects, leaves, dirt, and other foreign material that will restrict air flow.

(2) Inspect the cooling system for leaks. Replace worn or damaged hose connections. Tighten the hose clamps.

(3) Keep the water pump fan belt adjusted properly.

(4) If the engine becomes overheated from lack of coolant, let the engine run at a fast idle and add coolant slowly.

(5) If the engine overheats after refilling the cooling system, shut down the engine and allow it to cool. Drain the cooling system by opening the drain cocks on the radiator and the engine block, and flush out the system. Refill the cooling system with clean water; do not use salt or mineral water solutions in the cooling system.

(6) If the engine continues to overheat in operation, report the condition to organizational maintenance.

d. Batteries. Keep as much air as possible circulating around the batteries. Check the electrolyte level frequently; add distilled water as necessary to keep the electrolyte level 3/8 inch above the plates.

e. Engine Operation. Keep the air intake and exhaust openings clear. Keep the engine clean, and allow air to circulate freely around the engine.

(1) Avoid racing the engine, and avoid operating at full throttle when part throttle will handle the load.

(2) Avoid lugging the engine; keep the engine speed high enough to maintain the fan speed.

(3) Avoid idling the engine unnecessarily; shut the engine down during a lull in the operation.

2–28. Operation in Dusty or Sandy Areas

a. General. Operation in dusty or sandy areas presents special problems due to abrasive action of dust which shortens the life of parts. Make every effort to keep dust and sand out of the moving parts of the crane machinery and engine.

b. Lubrication. All lubricants and lubricating equipment must be kept clean. Service breathers and air cleaners frequently remove sand and dust. Lubricate more frequently to keep a supply of clean lubricant at moving parts. Clean all lubrication fittings thoroughly before attaching the grease gun.

c. Revolving Frame Live Roller Circle. Keep the roller path and rollers clean and dry. Do not lubricate the rollers or the roller path; lubricant on the rollers or roller path will collect sand and cause the rollers to wear excessively.

d. Clutches and Brakes. Inspect the clutch and brake linings frequently. After operation in dust or sand, blow loose grit out of linings. Failure to keep the linings clean will result in worn bands, scored drums, and unsatisfactory operation.

e. Cables. Keep unused cables in boxes. Clean and lubricate operating cables frequently.

f. Fuel System. Keep the fuel tank filler cap tight to prevent sand or dust from entering the fuel tank. Service the fuel filters frequently to keep them free from sand and grit.

g. Footings. Use wood blocking or mats under the outrigger jackfloats when operating in sand. See that the carrier does not shift during operation.

2–29. Operation in High Humidity or Salt Water Areas

a. General. Moisture and salt will cause deterioration of paint, cables, wiring, and all exposed metallic parts. Keep parts dry and well lubricated in high humidity or salt water conditions.

b. Wiring. The wiring of the truck crane has been moisture and fungus proofed, but the sheathing can be cracked and split during operation. Frequent inspections are necessary to detect worn spots from developing into short-circuit conditions. Report any such condition to organizational maintenance.

c. Corrosion Prevention. Completely remove rust and corrosion at the first appearance on any part of the truck crane. Wash off salt water and dry all parts thoroughly; paint the exposed surfaces immediately. Place a film of lubricant or grease on all polished or machined metal surfaces and other surfaces which cannot be painted.

d. Lubrication. Keep parts lubricated thoroughly to repel water from polished metal surfaces and to prevent the entry of water into bearings. Keep lifting cables lubricated as specified in paragraph 3-3.

2-30. Operation at High Altitudes

Operation at high altitudes presents special problems due to lower atmospheric pressure and wide temperature ranges. At altitudes above 5,000 feet it may be necessary to adjust the carburetor (refer this condition to organizational maintenance). Make certain that the air cleaner is clean and free from obstructions.

Caution: **Check the engine frequently for overheating in high altitude operation.**

CHAPTER 3

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR AND ORGANIZATIONAL MAINTENANCE REPAIR PARTS, TOOLS, AND EQUIPMENT

3-1. Tools and Equipment

a. Basic issue tools and repair parts issued with or authorized for the Model M320T Truck Crane are listed in the Basic Issue Items List, Appendix B of this manual.

b. No special tools or equipment are required by the operator or organizational maintenance personnel for maintenance of the Model M320T Truck Crane.

Section II. LUBRICATION

3-2. General Lubrication Information

For lubrication instructions refer to the current lubrication order (LO 5-3810-288-12).

Figure 3-1. Not used. See current lubrication order.

3-3. Detailed Lubrication Information

a. General. Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready to use.

b. Cleaning. Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

c. OES Oil.

(1) The crankcase oil level must be checked frequently, as oil consumption may increase.

(2) The oil may require changing more frequently than usual because contamination by dilution and sludge formation will increase under cold weather operation conditions.

d. Oil Filter Service. Service the oil filter as illustrated in figure 3-27.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-4. General

To insure that the Model M320T Truck Crane is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in paragraph 3-5. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 at the earliest possible opportunity.

3-5. Preventive Maintenance Checks and Services

See table 3-1 for a tabulated listing of preventive maintenance checks and services.

Table 3-1. Preventive Maintenance Checks and Services

Item Number	Interval						B—Before operation D—During operation	A—After operation W—Weekly	M—Monthly Q—Quarterly
	Operator					Org			
	Daily				M	Q			
	B	D	A	W			Item to be inspected	Procedure	Reference
	X		X				Fuel supply	Keep tank full.	Figure 3-6
				X			Fuel sediment bowl	Clean	Figure 3-5
	X		X				Radiator	Fill to ¾ inch above baffle plate.	Figure 3-3
	X		X				Engine oil dipstick	Add oil as indicated	
				X			Belts	Adjust as required	Figure 3-51
	X		X				Rain shutters	Open before starting engine. Close after stopping.	Figure 2-36
				X			Oildex filter	Clean glass cup when ½ full.	Figure 3-28
				X			Batteries	Check electrolyte level and tightness of connections. Fill to ⅜ inch (approx.) above the plates. In freezing weather, run the engine for one hour after adding water.	Figure 3-2
	X						Wire rope	Check for signs of wear or damage.	Paragraph 3-31
				X			Engine oil filters	Change filter elements	Figure 3-27
	X						Fire extinguisher	Check for broken seal and correct weight	Paragraph 3-32
	X						Hydraulic flued reservoir	Check level and add fluid if necessary	Figure 3-68
	X		X				Front drum clutch	Check operation, adjust if necessary.	Figure 3-9
	X		X				Rear drum clutch	Check operation, adjust if necessary.	Figure 3-9
	X		X				Boom hoist clutch	Check operation, adjust if necessary.	Figure 3-10
	X		X				Front drum brake	Check operation, adjust if necessary.	Figure 3-12
	X		X				Rear drum brake	Check operation, adjust if necessary.	Figure 3-12
	X		X				Boom hoist brake	Check operation, adjust if necessary.	Figure 3-13
				X			Swing brake	Check operation, adjust if necessary.	Figure 3-14
	X						Controls	With the unit running operate each control. See that the control functions properly.	Figure 2-36
	X						Boom and/or jib	Inspect visually for damage including cracks, breaks, and general condition.	Figure 3-23
	X						Sheaves and hook block	Inspect visually for damage including cracks, breaks, and general condition.	Figure 3-22
		X					Gages and instruments Coolant temperature Engine oil pressure Voltmeter Tachometer	Normal readings are: 160 to 200° F. 45 psi (maximum) See figure 2-37 2400 rpm (maximum) See paragraph 1-4.	Figure 2-36

Table 3-1. *Preventive Maintenance Checks and Services*—Continued

							Note. Operation. During operation, check all controls for proper operation. Also be alert for unusual noises and/or vibration.	
					X	Fuel supply	Keep tank full. Inspect fuel lines for leaks and tighten connections if necessary.	Figure 3–36
					X	Fuel sediment bowl	Clean. Check for leaks and tighten connections if necessary.	Figure 3–35
					X	Radiator	Fill to ¾ inch above baffle plate. Replace cracked or damaged hose. Tighten all mounting clamps and connections, if necessary, making sure no leaks are apparent. The correct cap pressure rating is 4 psi.	Figure 3–47
					X	Engine oil dipstick	Add oil as indicated.	
					X	Belts	Adjust as required. Replace worn, frayed, or cracked belts.	Figure 3–51
					X	Rain shutters	Open before starting engine. Close after stopping. Lubricate with OE lubricant and oil can (sparingly).	Figure 2–36
				X	X	Oildex filter	Clean glass cup when ½ full. Monthly or every 200 operating hours replace filter. Quarterly disassembly and clean entire unit.	Figure 3–28
					X	Batteries	Check electrolyte level and tightness of connections. Fill to ⅜ inch (approx.) above the plates. In freezing weather, run the engine for one hour after adding water. Clean vent hole in filler caps before installing caps. Replace a cracked and leaking battery.	Figure 3–2 and Figure 3–59
					X	Wire rope	Check for signs of wear or damage, including kinking, corrosion, broken strands, and cable clamp attachment. Replace seriously damaged wire rope.	Paragraph 3–31
					X	Engine oil filters	Change filter elements. Replace filter cover gaskets if necessary. Check for leaks and repair if necessary.	Figure 3–27
					X	Hydraulic fluid reservoir	Check level and add fluid if necessary. Every six months drain fluid and replace with new fluid.	Figure 3–68
					X	Front drum clutch	Check operation, adjust if necessary. Check lining thickness. If lining is worn to within 1/16 inch of rivet heads at point of most wear, install new lining.	Figure 3–10
					X	Rear drum clutch	Check operation, adjust if necessary. If lining is worn to within 1/16 inch of rivet heads at point of most wear, install new lining.	Figure 3–10
					X	Boom hoist clutch	Check operation, adjust if necessary. If lining is worn to within 1/16 inch of rivet heads at point of most wear, install new lining.	Figure 3–11

Table 3-1. *Preventive Maintenance Checks and Services*—Continued

Item Number	Interval						B—Before operation D—During operation	A—After operation W—Weekly	M—Monthly Q—Quarterly
	Operator					Org.			
	Daily				M	Q	Item to be inspected	Procedure	Reference
	B	D	A	W					
						X	Front drum brake	Check operation, adjust if necessary. If lining is worn to within 1/16 inch of rivet heads at point of most wear, install new lining.	Figure 3–12
						X	Rear drum brake	Check operation, adjust if necessary. If lining is worn to within 1/16 inch of rivet heads at point of most wear, install new lining.	Figure 3–12
						X	Boom hoist brake	Check operating, adjust if necessary. If lining is worn to within 1/16 inch of rivet heads at point of most wear, install new lining.	Figure 3–13
						X	Swing brake	Check operation, adjust if necessary.	Figure 3–14
						X	Controls	With the unit running, operate each control. See that the control functions properly. Inspect for damage, loose mounting, and missing mounting capscrews. Replace damaged items and missing capscrews.	Figure 2–36
						X	Boom and/or jib	Inspect visually for damage including cracks, breaks, and general condition. Repair or replace damaged boom or jib sections.	Figure 3–23
						X	Sheaves, and hook block	Inspect visually for damage including cracks, breaks, and general condition. Replace hook block if cracked or if there is a 15 per cent increase in distance from the hook point to internal surface of hook throat as compared to new hook block. Replace worn, cracked, or distorted sheaves.	Figure 3–22
						X	Gages and instruments Coolant temperature Engine oil pressure Voltmeter Tachometer	Normal readings are: 160 to 200° F. 45 psi (Maximum) See figure 2–37 2400 rpm (Maximum) See paragraph 1–4.	Figure 2–36
						X	Engine clutch	Adjust, if necessary	Figure 3–44
						X	Hook rollers	Inspect hook rollers for wear and proper adjustment. Maximum allowable clearance between hook rollers and lower side of roller path is 1/16 inch. Check for cracked hook roller brackets and weld is cracked.	Figure 3–97

						X	Operator's cab	Inspect window glass and replace cracked glass.	Figure 3-63
						X	Lights	Inspect all lights for loose cables, mountings, cracked lens, and proper operation. Repair or replace defective lamps or bulbs.	Figure 3-57
						X	Hoist chain and reversing chain	Inspect for wear and proper tension. Adjust tension if necessary. Replace chain if worn.	Figure 2-28 Figure 3-92
						X	Gantry	Inspect for cracks, worn sheaves, improper lubrication.	Paragraph 3-70

Section IV. OPERATOR'S MAINTENANCE

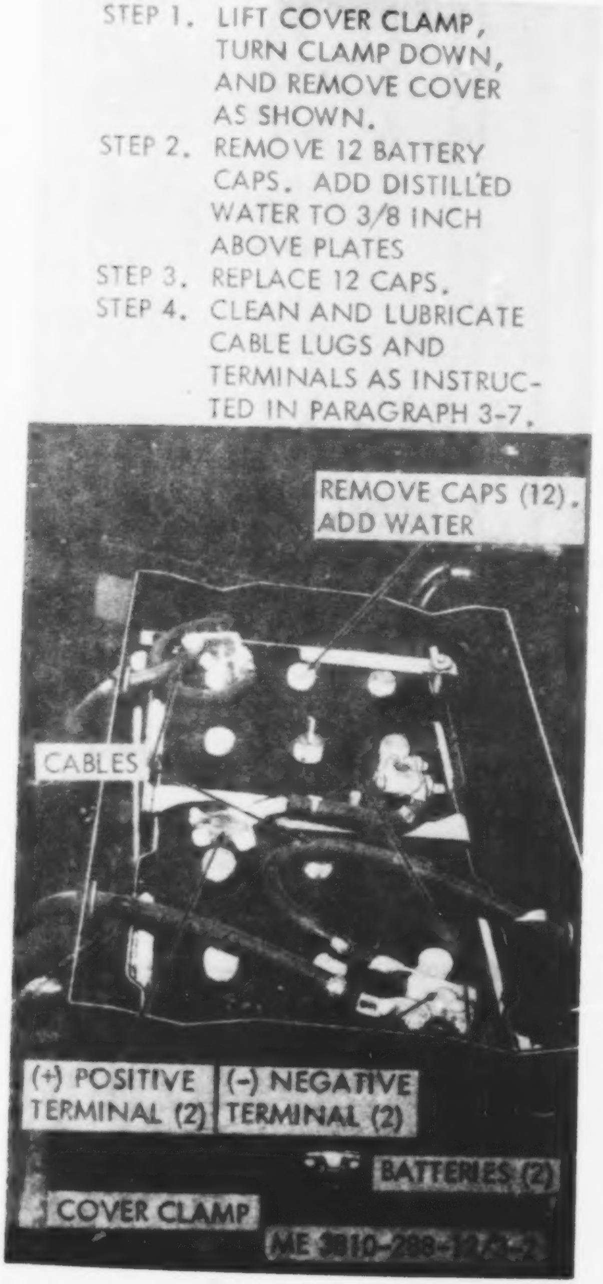
3-6. General

Instructions in this section are published for the information and guidance of the operator in maintaining the Model M320T Truck Crane. Services are grouped within this section by physical location, starting with the area around the engine, then those services within the operator's cab, and finally those services dealing with the attachment.

3-7. Battery Inspection and Service

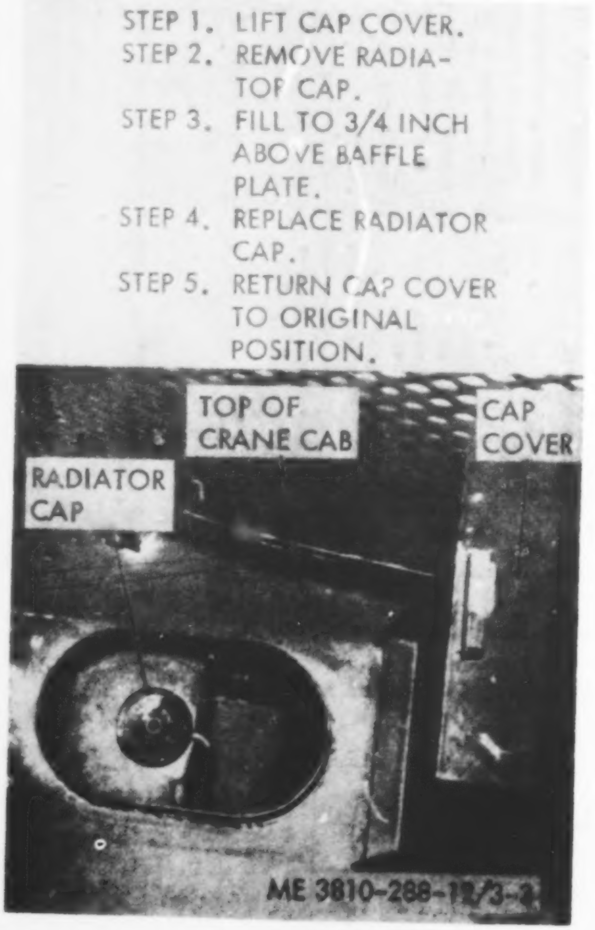
a. Inspect. Refer to Figure 3-2, and inspect batteries for cracks, leaks, or other damage. Inspect cables for frayed insulation, broken wires, bent or broken lugs, or corroded terminal lugs. Clean terminals and cable lugs of all corrosion and lubricate terminals and lugs with a light coating of grease, type GAA, as listed in the lubrication chart. Inspect the battery box for cracks, breaks, corrosion, or other damage.

b. Service. Remove twelve caps and add distilled water as required to bring the electrolyte level to approximately 3/8 inch above battery plates. In


STEP 1. LIFT COVER CLAMP, TURN CLAMP DOWN, AND REMOVE COVER AS SHOWN.
STEP 2. REMOVE 12 BATTERY CAPS. ADD DISTILLED WATER TO 3/8 INCH ABOVE PLATES
STEP 3. REPLACE 12 CAPS.
STEP 4. CLEAN AND LUBRICATE CABLE LUGS AND TERMINALS AS INSTRUCTED IN PARAGRAPH 3-7.

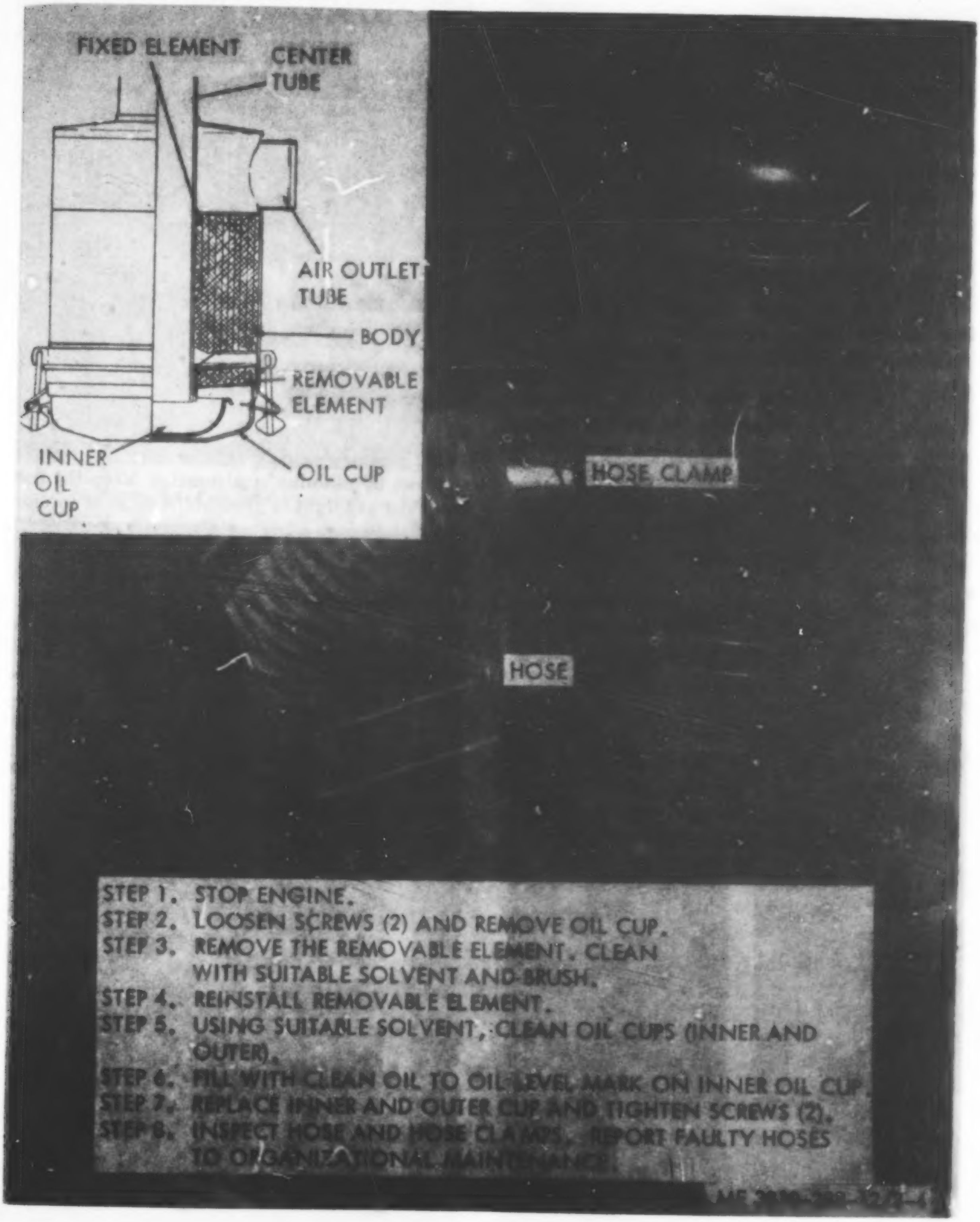
REMOVE CAPS (12). ADD WATER
CABLES
(+) POSITIVE TERMINAL (2)
(-) NEGATIVE TERMINAL (2)
BATTERIES (2)
COVER CLAMP
ME 3810-288-12/3-2

Figure 3-2. Battery inspection and service.


STEP 1. LIFT CAP COVER.
STEP 2. REMOVE RADIATOR CAP.
STEP 3. FILL TO 3/4 INCH ABOVE BAFFLE PLATE.
STEP 4. REPLACE RADIATOR CAP.
STEP 5. RETURN CAP COVER TO ORIGINAL POSITION.

TOP OF CRANE CAB
CAP COVER
RADIATOR CAP
ME 3810-288-12/3-3

Figure 3-3. Radiator service


FIXED ELEMENT
CENTER TUBE
AIR OUTLET TUBE
BODY
REMOVABLE ELEMENT
INNER OIL CUP
OIL CUP
HOSE CLAMP
HOSE
ME 3810-288-12/3-4

STEP 1. STOP ENGINE.
STEP 2. LOOSEN SCREWS (2) AND REMOVE OIL CUP.
STEP 3. REMOVE THE REMOVABLE ELEMENT. CLEAN WITH SUITABLE SOLVENT AND BRUSH.
STEP 4. REINSTALL REMOVABLE ELEMENT.
STEP 5. USING SUITABLE SOLVENT, CLEAN OIL CUPS (INNER AND OUTER).
STEP 6. FILL WITH CLEAN OIL TO OIL LEVEL MARK ON INNER OIL CUP
STEP 7. REPLACE INNER AND OUTER CUP AND TIGHTEN SCREWS (2).
STEP 8. INSPECT HOSE AND HOSE CLAMPS. REPORT FAULTY HOSES TO ORGANIZATIONAL MAINTENANCE.

Figure 3-4. Air cleaner service.

freezing weather, run the engine for at least one hour after adding water. Keep the batteries charged at all times.

3–8. Radiator Service

a. Refer to figure 3–3, and service the radiator. Add clean water to bring the level to ¾ inch above the baffle plate, if necessary.

Caution: **Turn radiator cap slowly and allow pressure to escape before removing it.**

b. Refer to TB ORD 651 for instruction concerning amount of antifreeze in cold weather operation.

3–9. Air Cleaner Service

Refer to figure 3–4 and service the air cleaner.

3–10. Fuel Filter (Sediment Bowl) Service

Refer to figure 3–5 and service the sediment bowl.

STEP 1. LOOSEN
STEP 2. TURN BAIL
SEDIMENT
NOT TO
STEP 3.

Figure 3–5. Sediment bowl service.

3–11. Engine Oil Pan Service

Stop engine. Refer to current LO and service the engine oil pan. Check oil level. Add oil if necessary. Recheck oil level.

3–12. Distributor (Ignitor) Service

No service is normally necessary for the distributor assembly. However, if the engine should fail to start, or if the distributor has become wet, remove the metal cover illustrated in figure 3–5 and dry the interior of the distributor cap and the points with a clean dry lint-free cloth. Inspect the distributor cover for cracks or damage. Inspect the rotor for cracks or damage. Inspect the points for excessive pitting or corrosion. Report deficiencies to Organizational Maintenance. Lubricate the distributor at the periodic intervals listed in the lubrication order.

3–13. Fuel Tank Service

The fuel tank should be kept as full as possible at all times to minimize condensation. Keep the fuel tank filler cap tight to prevent the entry of foreign material into the tank. Refer to figure 3–6. If water or other contamination is detected in the gasoline, refer to figure 3–7 and drain the tank at the tank drain beneath the revolving frame.

Figure 3–6. Fuel tank filler cap.

Figure 3-7. Fuel tank drain plug.

Figure 3-8. Transmission inspection and service.

3-14. Transmission Inspection and Service

a. Inspect. Refer to figure 3-8 and inspect the transmission breather cap for cleanliness. If necessary, rinse the cap in clean diesel fuel or kerosene and allow to drain dry before replacing. Inspect the transmission for signs of oil leaks or other damage.

b. Service. Refer to figure 3-8 and service the transmission.

3-15. Hydraulic System

a. Inspect. Refer to figure 3-68 and inspect the hydraulic fluid reservoir to be sure it is filled to the level mark. Add oil if necessary. Visually inspect all hydraulic lines, fittings, cylinders, and valves for leaks. Be careful to inspect all brake and clutch cylinders for leaks, since leaks in these areas could cause hydraulic fluid to touch brake or clutch linings, thus causing the brake or clutch affected to slip. Tighten any loose connections. Report any other deficiencies to higher authority.

b. Test. Refer to the rating plate, figure 1-9, and determine maximum rated load for the length of crane boom installed. Start the engine. See paragraph 2-16. Using a load approximately equal to maximum rated load for the conditions under which the crane is being operated, lift the load a few inches above the ground. See that clutches are adjusted and operating correctly so that the load is lifted smoothly. Apply the appropriate drum brake and see that the brake will hold the load suspended. Lift and lower the boom, being careful not to exceed rating plate maximum loads while so doing. Test all hydraulically operated controls to be sure that they perform normally.

3-16. Lights

Refer to the upper (crane) controls illustration, figure 2-36, and to the carrier (lower) controls illustration, figure 6-1. Turn on each internal cab light and external light, in turn, and check for correct operation. Check headlights in both the bright and dim conditions. Check directional signals in both directions. Check the operation of the two reel-mounted lights, one in each cab. Be sure dome and dash board lights operate. See that floodlights are adjusted so as to provide adequate lighting around the entire working area. Refer any deficiencies to organizational maintenance.

3-17. Horn

Depress the upper machinery horn button (fig. 2-36) and the carrier horn (fig. 6-1) and see that the horns operate properly. Check visible wiring to horn buttons for worn or frayed insulation. Report deficiencies to organizational maintenance.

3-18. Tachometer

With the engine running, check tachometer readings. At low idle, the reading should be about 500 rpm (revolutions per minute). At high idle, the reading may be as high as 2,000 rpm. Under full load, the reading should be about 1800 rpm. Report any major deviations to organizational maintenance.

3-19. Rear Drum Clutch Service and Adjustment

a. Service. Keep the mechanical components of the clutch clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings.

b. Adjust. Refer to figure 2-36 and place the rear drum clutch lever in the centered (neutral) position. Refer to figure 3-9 and adjust the rear drum clutch. Position the clutch as desired by "tapping" the engine start pushbutton, with the ignition switch in the OFF position.

3-20. Front Drum Clutch Service and Adjustment

a. Service. Keep the mechanical components of the clutch clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings.

b. Adjust. Adjustment of this clutch is identical to the adjustment of the rear drum clutch, except that the front drum clutch lever instead of the rear drum clutch lever (fig. 2-36) must be placed in the centered (neutral) position. Refer to figure 3-9 and adjust the front drum clutch. Position the clutch as desired by "tapping" the engine start pushbutton, with the ignition switch in the OFF position.

3-21. Boom Hoist Clutch Service and Adjustment

a. Service. Keep the mechanical components of the boom hoist clutch clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings.

b. Adjust. Refer to figure 2-36 and place the boom hoist clutch lever in the centered (neutral) position. Refer to figure 3-10 and adjust the boom hoist clutch.

3-22. Reversing Shaft and Horizontal Swing Shaft Clutch Service and Adjustment

a. Service. Keep the mechanical components of the reversing shaft clutch and the horizontal swing shaft clutches clean and dry. Do not allow hydraulic fluid to come into contact with clutch linings. Both swing clutches and the reversing shaft clutch are identical.

b. Adjust. Refer to figure 2-36 and place the control lever for the clutch being adjusted in the centered (neutral) position. Refer to figure 3-11 and adjust the reversing shaft clutch or the horizontal swing shaft clutch.

3-23. Front and Rear Drum Brake Service and Adjustment

a. Service. Keep the mechanical components of the rear drum brake clean and dry. Do not allow hydraulic fluid to come into contact with brake linings.

b. Adjust. The adjustment of both of these brakes is identical and is done with hydraulic pressure off. No pressure should be placed on the operating foot pedal. Refer to figure 3-12 and adjust the front or rear drum brake.

3-24. Boom Hoist Brake Service and Adjustment

a. Service. Keep the mechanical components of the boom hoist brake clean and dry. Do not allow hydraulic fluid to come into contact with brake linings.

b. Adjust. Refer to figure 3-13 and adjust the boom hoist brake.

Warning:* Always lower the attachment to the ground before attempting to adjust the boom hoist brake. Serious damage to the equipment or injury to personnel may otherwise result.

3-25. Swing Brake Service and Adjustment

a. Service. Keep the mechanical components of the swing brake clean. Keep locknuts tightened.

b. Adjust. Refer to figure 2-36 and place the swing brake lever in the released position. Refer to figure 3-14 and adjust the swing brake.

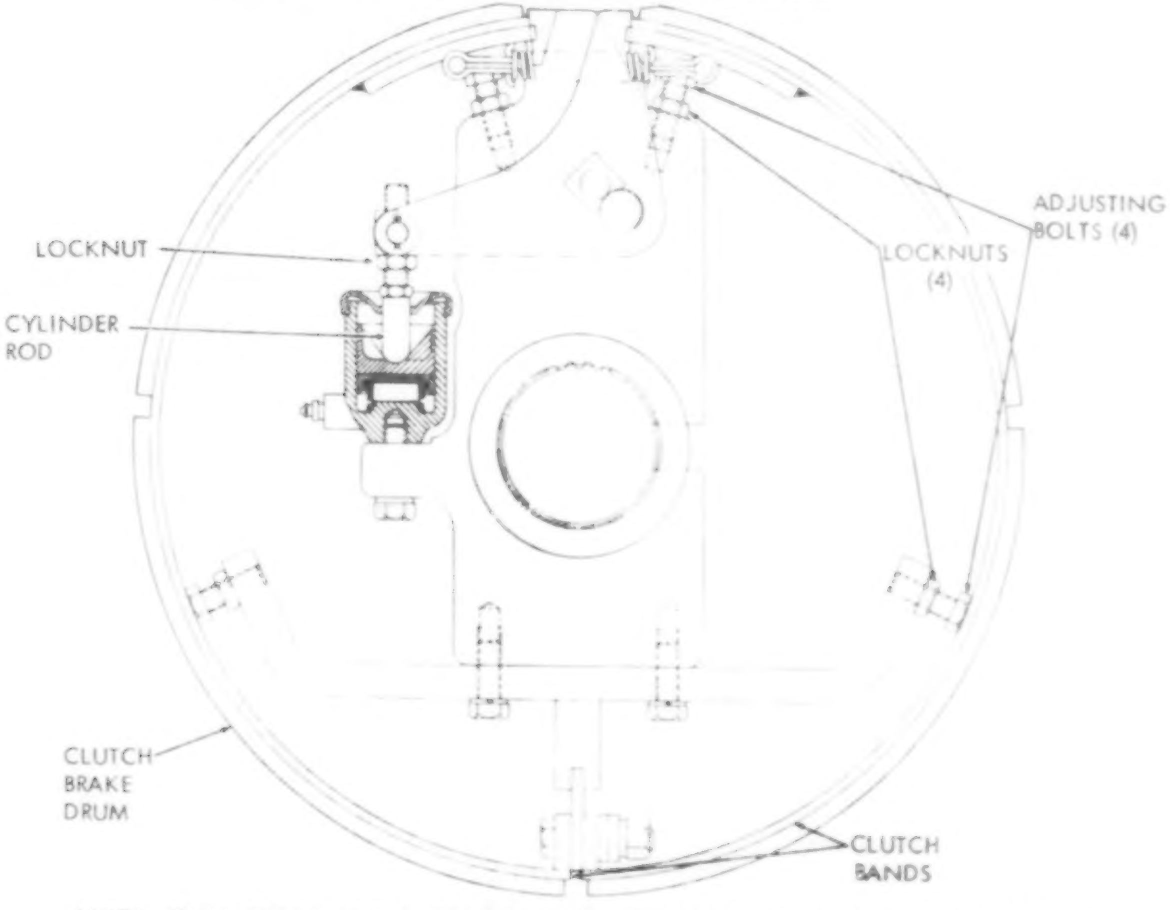
Note. The swing brake is not used to stop the revolving frame from swinging while the machine is in operation. It is used solely to prevent the revolving frame from turning while the machine is not in use, such as when it is being moved from place to place.

STEP 1. LOOSEN LOCKNUTS (4) WHICH SECURE ADJUSTING BOLTS (4).

STEP 2. TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH BANDS. CLUTCH BANDS MUST BE CENTERED IN CLUTCH DRUM. USE ADJUSTING BOLTS (4) TO CENTER CLUTCH BANDS. TIGHTEN LOCKNUTS.

STEP 3. LOOSEN LOCKNUT ON CYLINDER ROD.

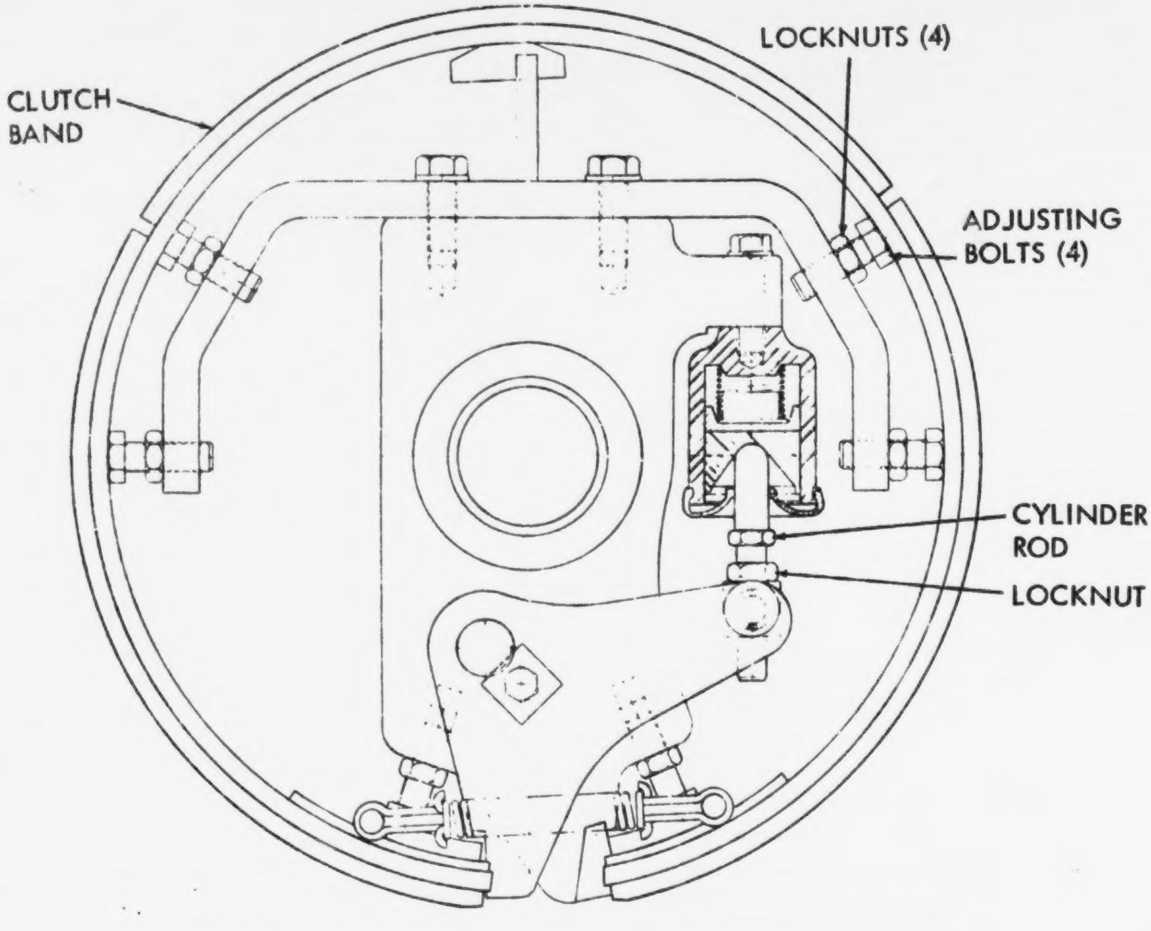
STEP 4. TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH. TIGHTEN LOCKNUT.


LOCKNUT
CYLINDER ROD
ADJUSTING BOLTS (4)
LOCKNUTS (4)
CLUTCH BRAKE DRUM
CLUTCH BANDS

NOTE: ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN CLUTCH HAS BEEN REMOVED AND REPLACED.

ME 3810-288-12/3-9

Figure 3-9. Adjusting front and rear drum clutch.



STEP 1. LOOSEN LOCKNUTS WHICH SECURE ADJUSTING BOLTS.

STEP 2. TURN ADJUSTING BOLTS OUT OF CONTACT WITH CLUTCH BAND. CLUTCH BAND MUST BE CENTERED IN CLUTCH DRUMS. USE ADJUSTING BOLTS TO CENTER CLUTCH BAND. TIGHTEN LOCKNUTS.

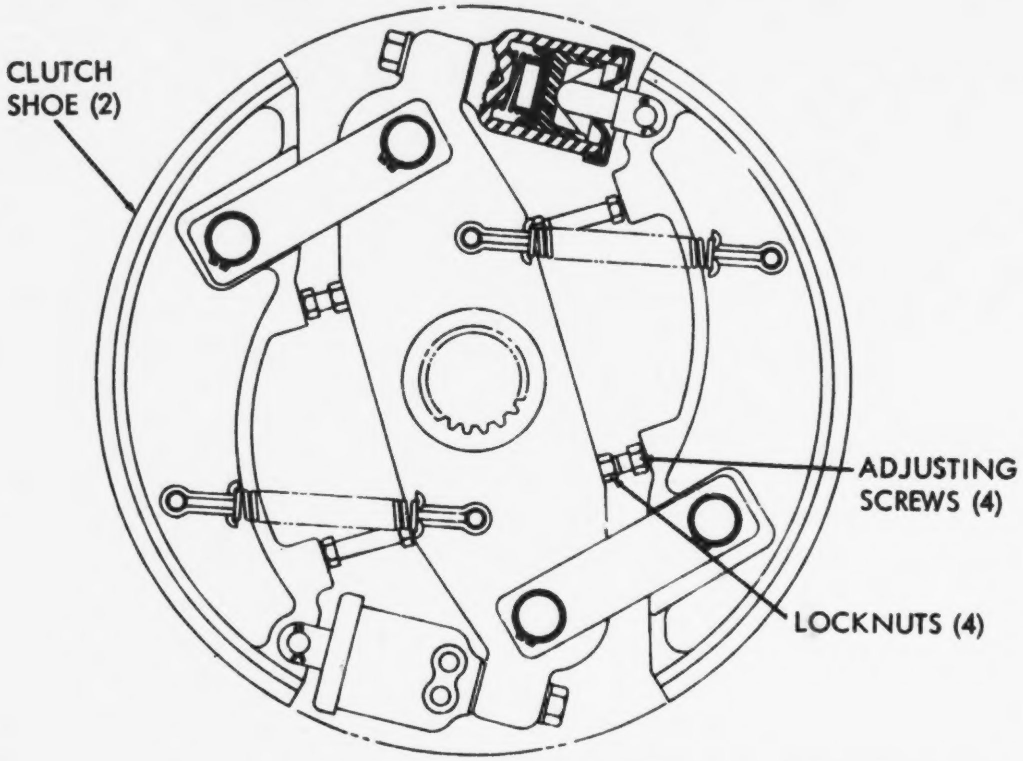
STEP 3. LOOSEN LOCKNUT ON CYLINDER ROD.

STEP 4. TURN CYLINDER ROD OUT UNTIL A PULL OF 15 TO 20 POUNDS ON A SPRING SCALE IS NEEDED TO ENGAGE THE CLUTCH. TIGHTEN LOCKNUT ON CYLINDER ROD.

NOTE: ONLY STEPS 3 AND 4 ABOVE ARE NECESSARY TO ADJUST FOR LINING WEAR. USE COMPLETE PROCEDURE ONLY WHEN CLUTCH HAS BEEN REMOVED AND REPLACED.

ME 3810-288-12/3-10

Figure 3-10. Adjusting boom hoist clutch.



STEP 1. LOOSEN LOCKNUTS ON ADJUSTING SCREWS.
STEP 2. REFER TO FIGURE 2-36 AND ENGAGE THE SWING CLUTCH LEVER.
STEP 3. BACK OFF ON ALL ADJUSTING SCREWS UNTIL THERE IS A 0.020 INCH GAP BETWEEN HEADS OF ADJUSTING SCREWS AND CLUTCH SHOES. TIGHTEN LOCKNUTS AND RECHECK GAP.

NOTE: MAKE ABOVE ADJUSTMENT FOR FIRST ONE CLUTCH SHOE AND THEN THE OTHER. BE SURE CLUTCH SHOES DO NOT DRAG.

ME 3810-288-12/3-11

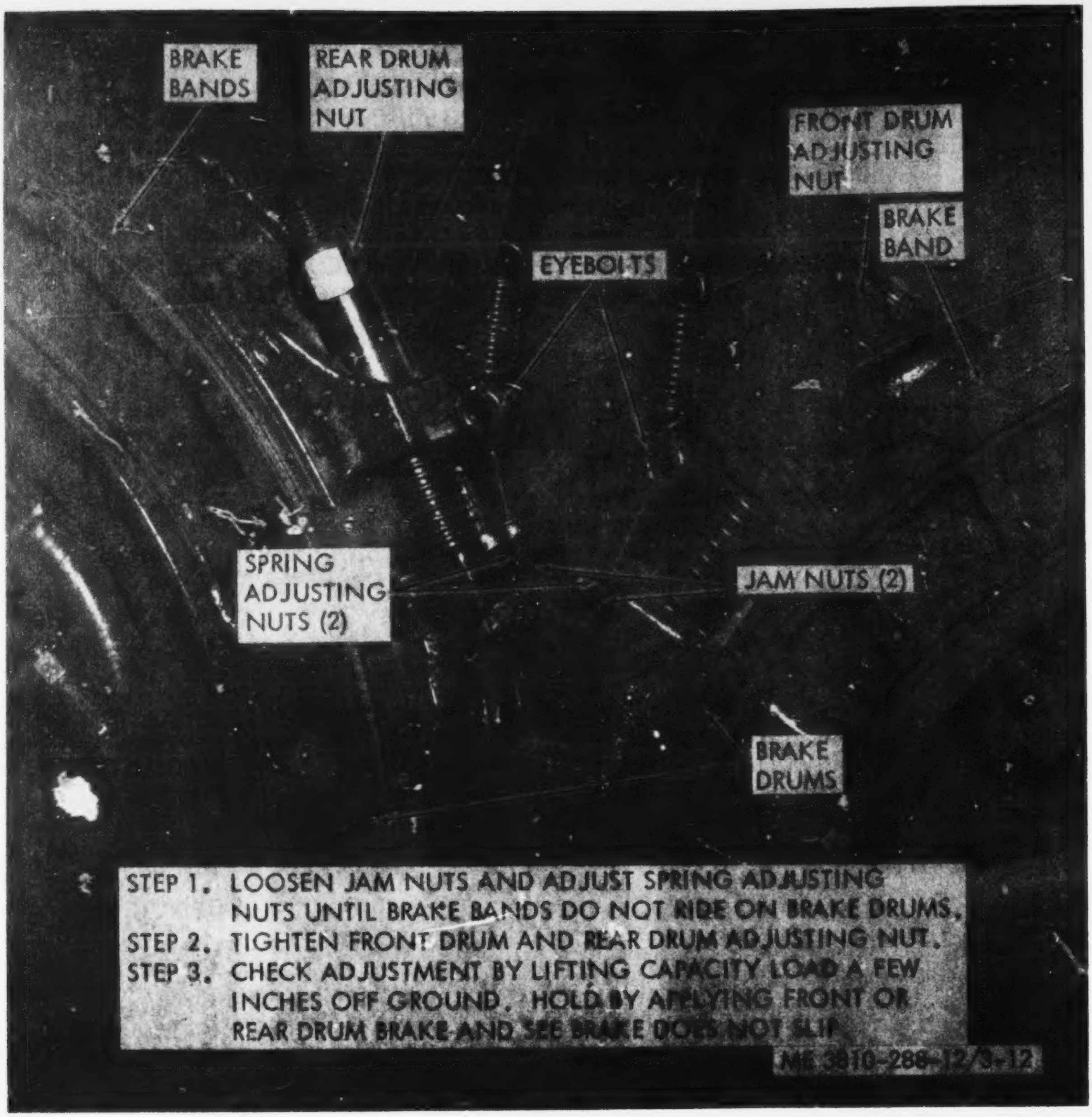
Figure 3-11. Adjusting reversing shaft clutch or horizontal swing shaft clutch.

3-26. Control Levers and Pedals

a. Service. No service except lubrication and cleaning is required for control levers or pedals. Lubricate in accordance with the lubrication order.

b. Adjust. No adjustments should normally be required. However, stop-screws (adjusting screws) are furnished to limit the fore and aft movement of all control levers and pedals, as illustrated in figure 3-16. Operators will adjust only spring return tension on front and rear drum brake pedals, and this adjustment will be made only after carefully checking front and rear drum brake adjustment. Refer to figure 3-15.

c. Toggle Levers. The front drum clutch lever, the rear drum clutch lever, the boom hoist clutch lever, and the swing brake lever are designed to


BRAKE BANDS
REAR DRUM ADJUSTING NUT
FRONT DRUM ADJUSTING NUT
BRAKE BAND
EYEBOLTS
SPRING ADJUSTING NUTS (2)
JAM NUTS (2)
BRAKE DRUMS
ME 3810-288-12/3-12

STEP 1. LOOSEN JAM NUTS AND ADJUST SPRING ADJUSTING NUTS UNTIL BRAKE BANDS DO NOT RIDE ON BRAKE DRUMS.
STEP 2. TIGHTEN FRONT DRUM AND REAR DRUM ADJUSTING NUT.
STEP 3. CHECK ADJUSTMENT BY LIFTING CAPACITY LOAD A FEW INCHES OFF GROUND. HOLD BY APPLYING FRONT OR REAR DRUM BRAKE AND SEE BRAKE DOES NOT SLIP.

Figure 3-12. Adjusting front and rear drum brakes.

"toggle in". Figure 3-16 illustrates the principles of operation of toggle linkage, which must be understood in order to adjust such linkage. When the linkage moves from the neutral position shown in sketch 1, point A approaches the straight line (or toggle point), as shown in sketch 2.

In the position shown in Sketch 2, the greatest possible amount of force is exerted outward against points B and C, with little effort on the part of the operator. Therefore, the linkage can be returned to either the neutral position or the "toggled in" position with a minimum amount of effort. All the operator has to do is provide the amount of force needed to push the lever past the toggle point in either direction, and the force exerted against points B and C will force the

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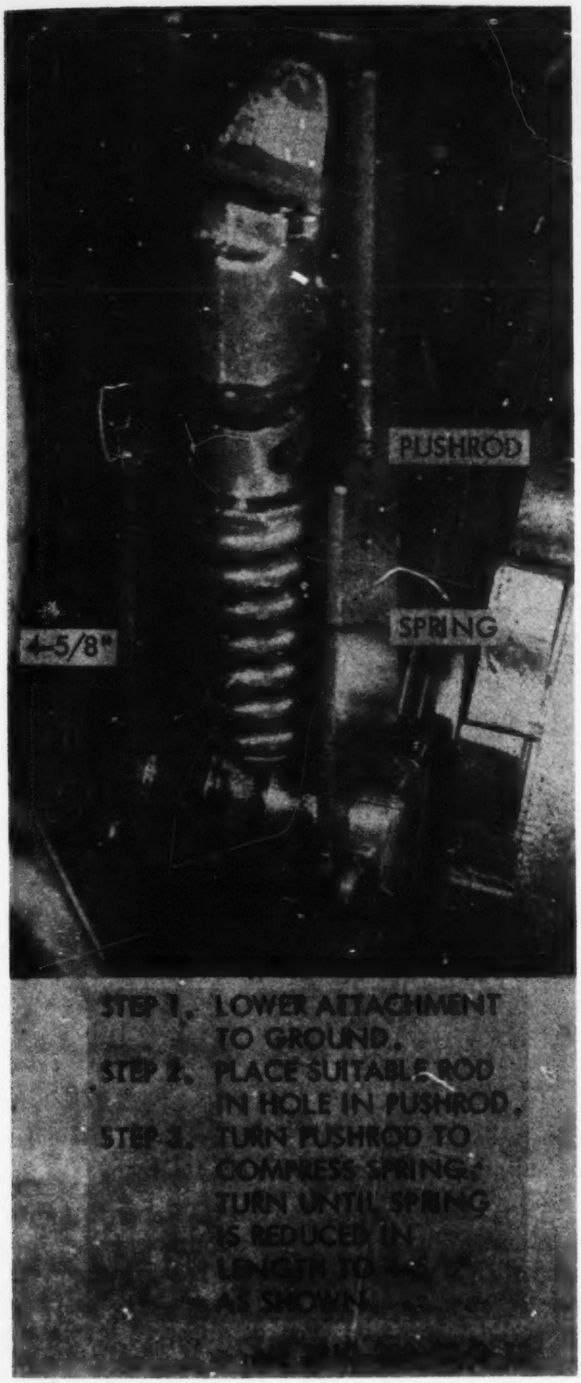


STEP 1. LOWER ATTACHMENT TO GROUND.
STEP 2. PLACE SUITABLE ROD IN HOLE IN PUSHROD.
STEP 3. TURN PUSHROD TO COMPRESS SPRING; TURN UNTIL SPRING IS REDUCED IN LENGTH TO 4-5/8" AS SHOWN.

Figure 3–13. Adjusting boom hoist brake.

lever as far in that direction as it can go. In Sketch 3, the operator has pushed the control lever past the toggle point. The lever will now stay in the forward position until the operator pulls it back, past the toggle point, to the neutral (centered) position. It is most important that only the four levers which are designed for toggle linkage action, and which are listed above be allowed to "toggle in". Refer to figure 3–16 and adjust toggle linkage.

3–27. Shovel Front Attachment

a. Service. The shovel front must be lubricated at the periodic intervals listed in the lubrication order. When removed from the machine, all exposed finished surfaces must also be lubricated as often as required to prevent damage due to rust and corrosion. If possible, the entire attachment should be placed inside a suitable dry building, preferably on wooden blocking. The shovel front should be cleaned using an approved cleaning solution.

b. Adjust. Each of the following adjustments must be checked every 40 hours of shovel operation. Adjust only if necessary.

(1) *Saddle block adjustment.* Shims and wear plates are used to adjust the clearance between the dipper stick and the saddle block wear plates as shown in figure 3–17. The desired minimum clearances between wear plates and saddle blocks are 1/64 inch at each location. Adjustment is mandatory when clearance reaches 1/16 inch at any point illustrated. Use the following procedure for adjustment.

(*a*) Support the dipper stick in a horizontal position, using the hoist line.

(*b*) Divide the dipper stick into three approximately equal lengths, using chalk marks or paint.

(*c*) Move the dipper stick back and forth a few times to make sure it is free in the saddle blocks and in it's normal operating condition.

(*d*) Position the dipper stick so that the outer third of the dipper stick, as measured by the chalk or paint marks, is located in the saddle block. Measure the clearance between the wear plates on each side of the dipper stick and the dipper stick. Record the clearance measured.

(*e*) Measure the clearance between the top of the dipper stick and the wear plate at each

Figure 3-14. Swing brake adjustment.

end of the saddle block and record this measured clearance.

(*f*) Repeat steps (*d*) and (*e*) above for each of the other two marked sections of the dipper stick, each time recording the measurements.

(*g*) Loosen wear plate bolts and insert shims beneath the wear plates until the clearance between the dipper stick and the wear plates is approximately 1/64 inch, at the thickest point of the dipper stick. Adjust both top and side clearances in this manner. Shims are slotted so that they may be tapped into place without removing the wear plates.

(2) *Crowd chain adjustment.* Adjust for crowd chain wear as illustrated in figure 2-28. Total midspan slack at the top of the chain must be maintained at approximately 1¼ inch.

(3) *Rake angle adjustment.* Refer to figure 3-18 and adjust the dipper pitch braces in accordance with the type of material being moved and the working conditions. In general, pin the pitch brace in hole 1 for easy digging and low bank cuts. Pin the brace in hole 2 for medium or average soil conditions and bank heights, and in hole 3 for hard digging, high banks, and when grading the area.

(4) *Retract cable tension adjustment.* Refer to figure 3-18 and adjust retract cable tension.

(5) *Dipper trip cable adjustment.* This adjustment should not normally be necessary unless

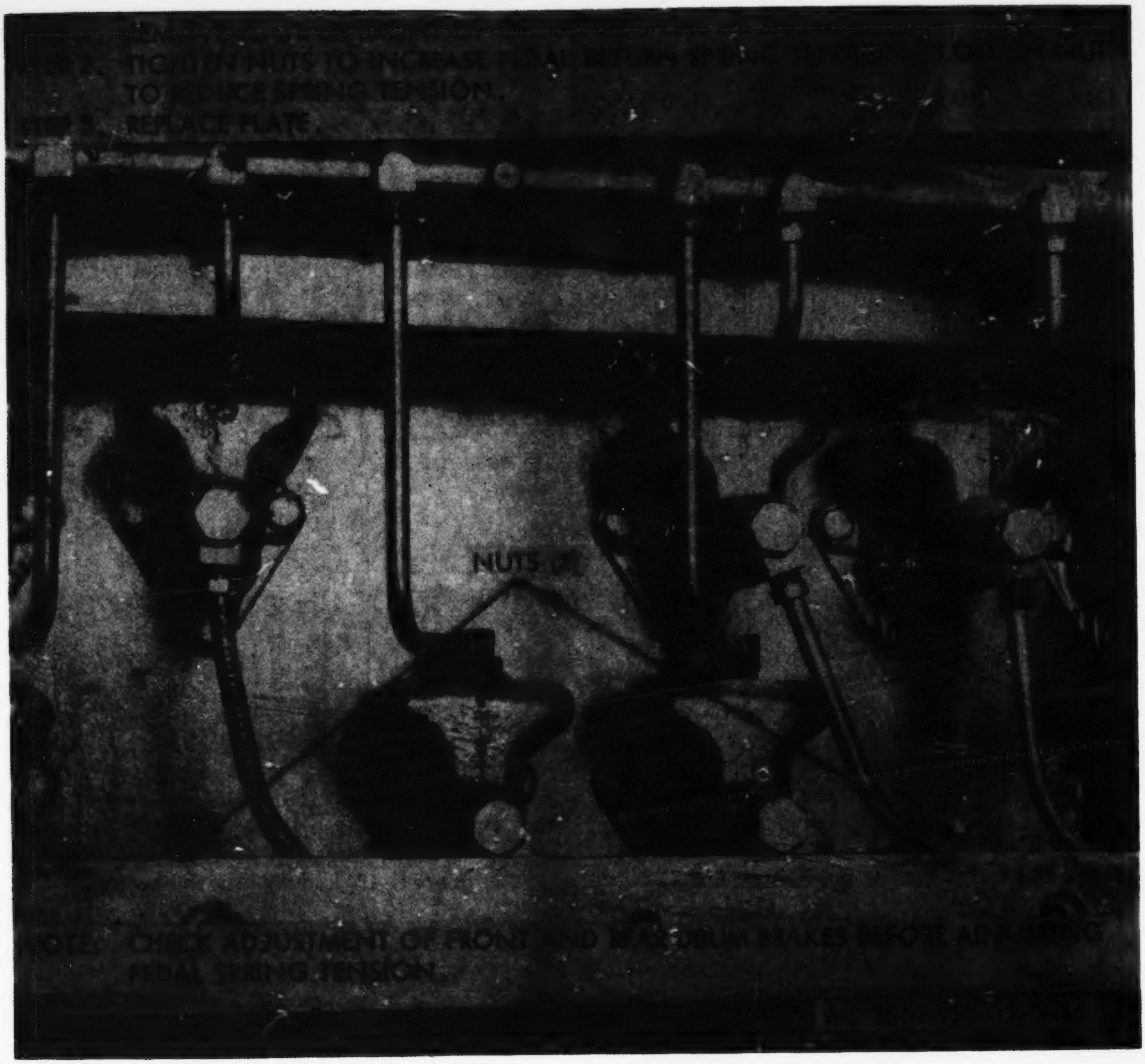

EP 2. TIGHTEN NUTS TO INCREASE PEDAL RETURN SPRING TENSION. LOOSEN NUT TO REDUCE SPRING TENSION.
EP 3. REPLACE PLATE.
NUTS (2)
OTE: CHECK ADJUSTMENT OF FRONT AND REAR DRUM BRAKES BEFORE ADJUSTING PEDAL SPRING TENSION.

Figure 3–15. Adjusting front and rear drum brake pedal return spring tension.

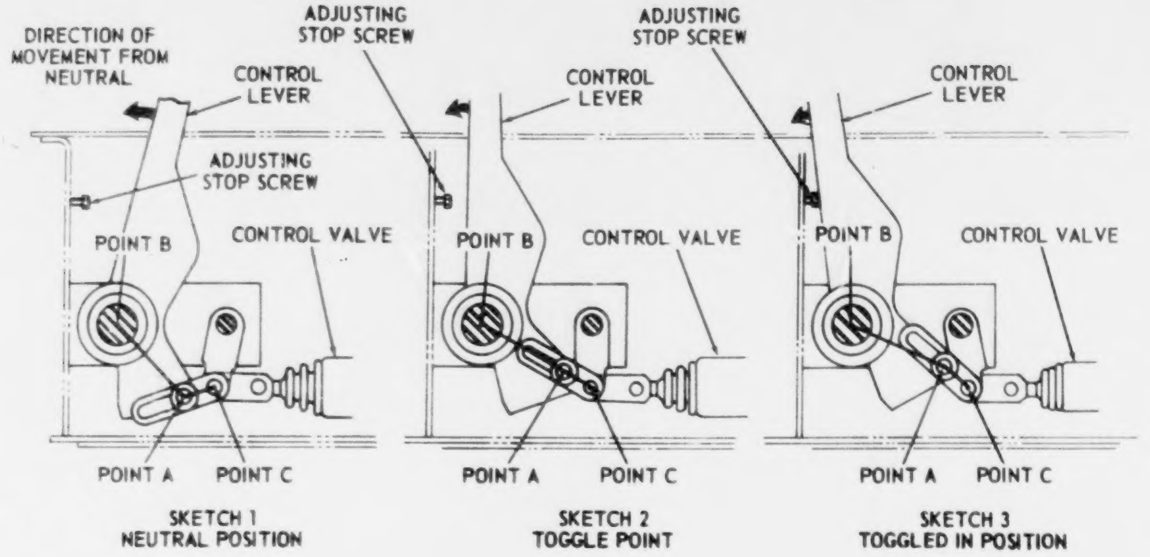
the dipper trip cable wears or stretches. Therefore, the cable should be inspected to determine that it is safe for further use before it is adjusted. Refer to figure 3–19 and adjust the dipper trip cable tension.

(6) *Dipper tooth replacement.* Dipper teeth can be kept sharp in service by regularly reversing them, top for bottom, as they wear. When teeth are worn to about one third their original length, they must be replaced. Drive out the attaching pins and replace dipper teeth. Note that no digging should ever be done with dipper teeth removed, since severe wear can occur to the exposed mounting surfaces.

(7) *Dipper latch bar adjustment.* The dipper latch bar must be adjusted to move forward into the opening in the dipper latch as latch bar wear occurs. Refer to figure 3–20 and adjust the dipper latch bar.

3–28. Crane, Clamshell, and Dragline Attachment

a. General Service. The components of the crane attachment must be lubricated at the periodic


DIRECTION OF MOVEMENT FROM NEUTRAL
ADJUSTING STOP SCREW
CONTROL LEVER
ADJUSTING STOP SCREW
POINT B
CONTROL VALVE
POINT A
POINT C
SKETCH 1
NEUTRAL POSITION
ADJUSTING STOP SCREW
CONTROL LEVER
POINT B
CONTROL VALVE
POINT A
POINT C
SKETCH 2
TOGGLE POINT
ADJUSTING STOP SCREW
CONTROL LEVER
POINT B
CONTROL VALVE
POINT A
POINT C
SKETCH 3
TOGGLED IN POSITION

ME 3810-288-12/3-16

Figure 3-16. Toggle linkage adjustment.

intervals listed in the lubrication order. When removed from the machine, the crane boom should be placed inside a suitable dry building if possible, preferably supported on wooden blocking. Clean the crane boom, using a cleaning solution. All machined or finished surfaces must be kept lubricated, as required, to prevent rust.

b. Cable Roller and Boom Point Sheave Service. Refer to figure 3-21 and clean the cable rollers and boom point sheaves with a cleaning solution. Inspect for wear, scoring, or grooving caused by contact between cables and rollers or sheaves. Report any such discrepancy to higher authority.

c. Hook Block Service and Replacement. The operator's responsibility in regard to hook block service and the method of replacement are outlined below.

(1) *Service.* The hook block (fig. 3-22) must be kept clean. Keep the hook block sheaves lubricated with proper lubricant in accordance with the lubrication order. The hook block must be inspected by the operator daily, since failure could cause serious damage or injury. The operator must inspect for visible cracks or noticeable increase in hook throat measurements, and report any evidence of a defect to proper authority.

(2) *Replacement.* Lower the hook block to the ground or to suitable blocking. Loosen the cable clamp at the cable dead end. This may be at the boom point or the hook block, depending on the number of parts of line in use. Manually unreeve the hook block. Refer to the reeving diagram, figure 2-15, and replace the hook block.

d. Jib and Jib Strut Service and Replacement. Service and replacement procedures for the jib and jib strut are described below.

(1) *Service.* Service of the jib and jib strut is the same as for the crane boom. Refer to paragraph 3-28 (*a*) and service the jib and jib strut.

(2) *Replacement.* Refer to figure 3-23 and replace the jib and jib strut.

e. Cable Replacement. Replacement procedures for cables are described below.

(1) *Replacement of load cables.* To replace either the front or the rear drum load cable, place the drum brake for the cable to be removed in the brake released position. Refer to paragraph 3-28(*c*) and remove the hook block. Raise the boom to any convenient height so that the line hangs downward One man can now pull the cable off the drum. When the cable end is reached, refer to fig-

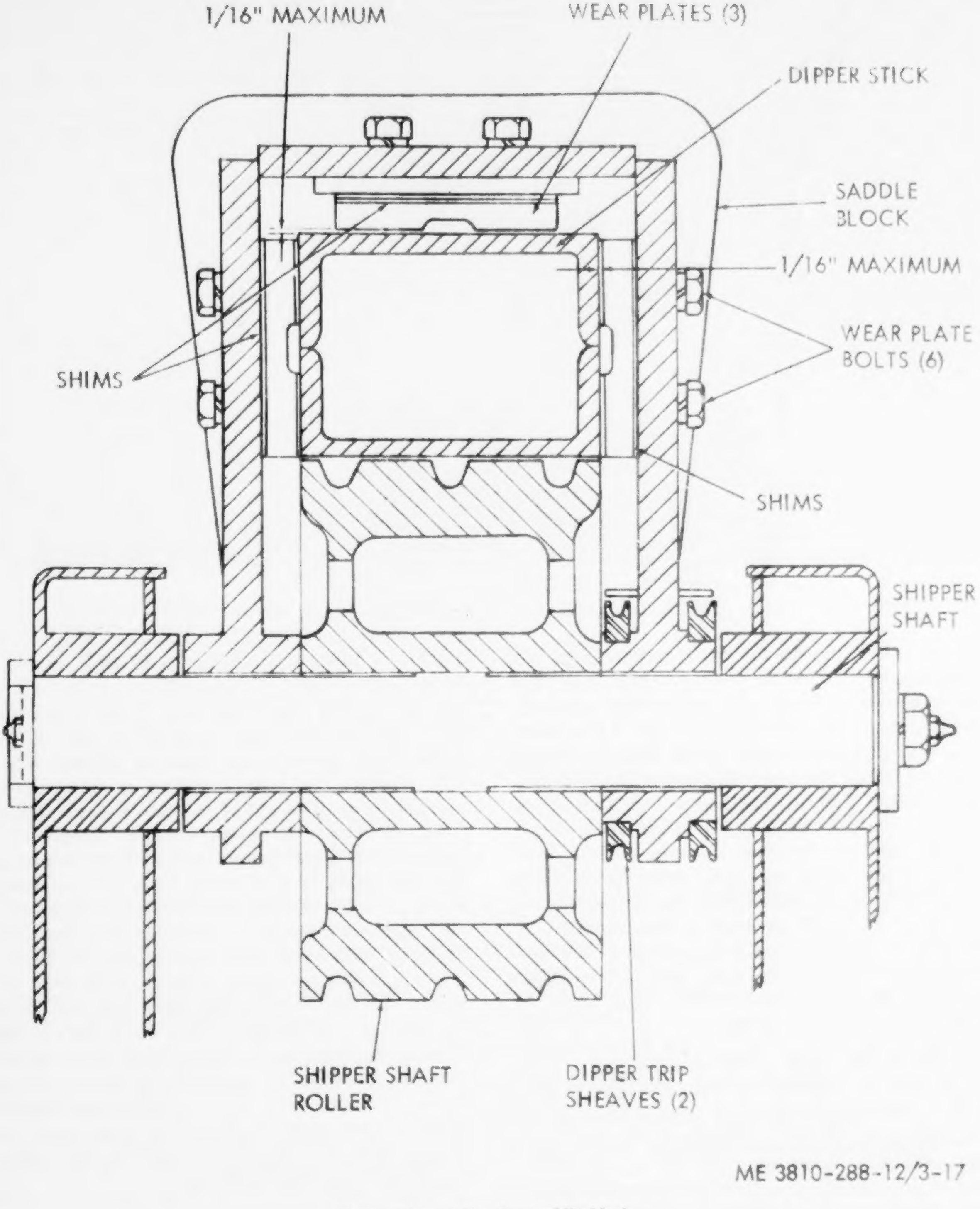
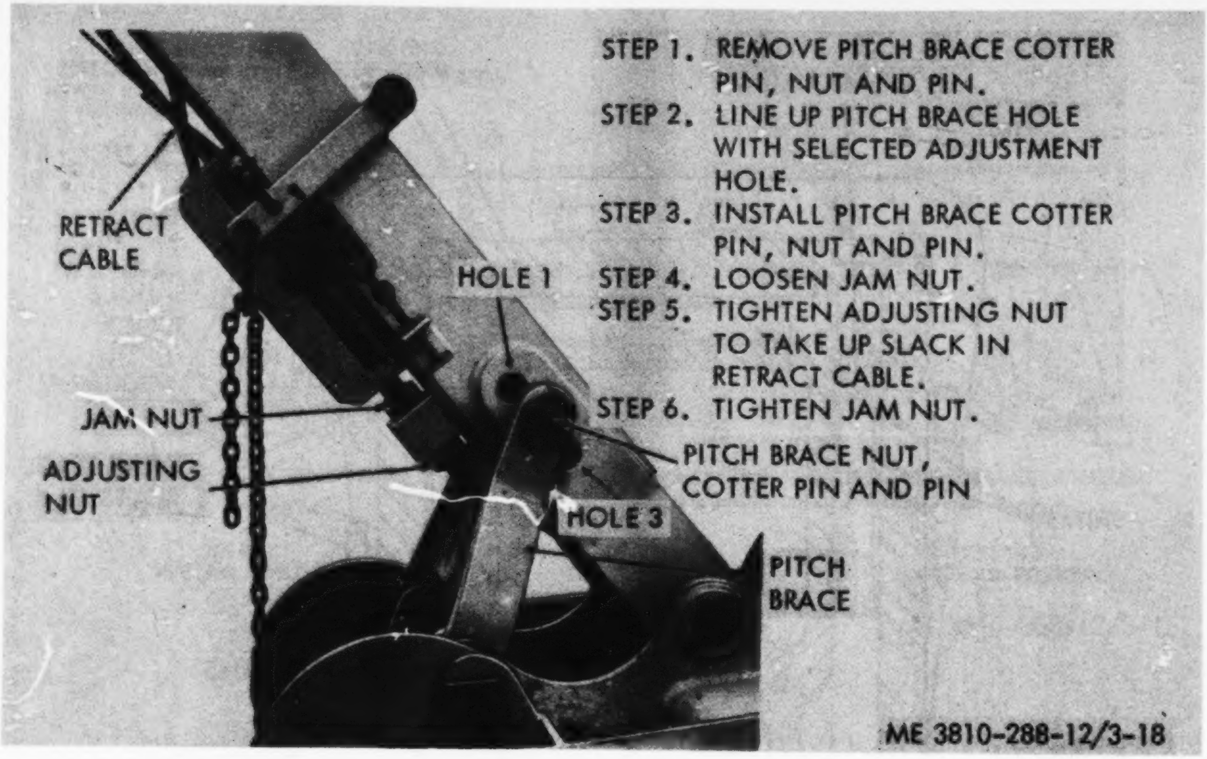

1/16" MAXIMUM
WEAR PLATES (3)
DIPPER STICK
SADDLE BLOCK
1/16" MAXIMUM
WEAR PLATE BOLTS (6)
SHIMS
SHIMS
SHIPPER SHAFT
SHIPPER SHAFT ROLLER
DIPPER TRIP SHEAVES (2)
ME 3810-288-12/3-17

Figure 3-17. Adjusting saddle block.



STEP 1. REMOVE PITCH BRACE COTTER PIN, NUT AND PIN.
STEP 2. LINE UP PITCH BRACE HOLE WITH SELECTED ADJUSTMENT HOLE.
STEP 3. INSTALL PITCH BRACE COTTER PIN, NUT AND PIN.
STEP 4. LOOSEN JAM NUT.
STEP 5. TIGHTEN ADJUSTING NUT TO TAKE UP SLACK IN RETRACT CABLE.
STEP 6. TIGHTEN JAM NUT.

ME 3810-288-12/3-18

Figure 3–18. Rake angle and retract cable adjustment.

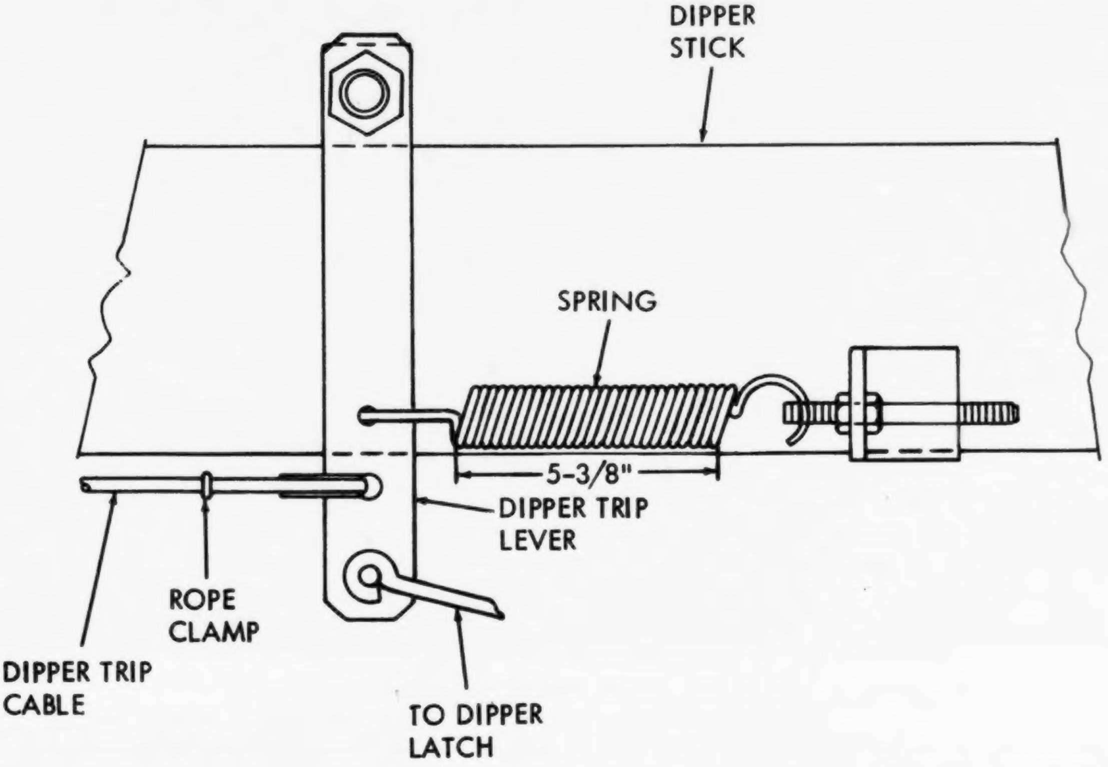
ure 2–14 and remove the cable wedge from the drum lagging. To install the new cable, place the new cable reel beneath the boom point sheaves. Run the end of the new cable over the boom point sheaves to the correct main drum. Refer to figure 2–14 and install the new cable wedge in the drum, being careful that the cable goes over the top of the rear drum, or beneath the front drum. Very carefully and slowly spool the new cable on the selected drum, using the proper drum clutch lever. As this is done, one man should tap the new cable into place on the drum with a soft hammer. A second man should maintain some drag on the new cable reel so the cable is under tension. The third man operates the proper drum clutch lever to wind the cable on the drum.

(2) *Replacement of boom hoist cable.* Provide adequate wooden blocking to support the boom. Lower the boom until it is supported on blocking as illustrated in figure 2–7. Pay off more cable until the upper spreader lies on the boom. Refer to figure 3–24 and disconnect the boom hoist cable from the lower spreader. Refer to figure 2–36 and release the boom hoist pawl and the boom hoist brake. Unreave the boom hoist line and pull it from the boom hoist drum. The boom hoist drum can be used to pay the line off the drum under power if the operator desires. When this is done, one man standing on the ground must pull the cable out of the cab. Refer to figure 2–14 and remove the cable wedge to complete removal of the cable. Bring the cable reel containing the new cable to a position close to the upper spreader and near the boom. Starting at the center (equalizer) sheave of the upper spreader reeve the boom hoist cable back to the dead end on the lower spreader as shown in figure 3–24. Pull the rest of the cable off the new cable reel and reeve the other half of the boom hoist cable, back to the boom hoist drum, as shown in figure 2–13. Install the new cable wedge in the boom hoist drum as shown in figure 2–14. Very carefully and slowly spool the new cable on the boom hoist drum. As this is done, one man should tap the new cable into place with a soft hammer.

f. Clamshell and Dragline Bucket Service and

STEP 1. LOOSEN ROPE CLAMP.
STEP 2. TIGHTEN DIPPER TRIP CABLE UNTIL DIPPER TRIP LEVER IS AT RIGHT ANGLE TO DIPPER STICK.
STEP 3. TIGHTEN ROPE CLAMP.

NOTE: SPRING LENGTH SHOULD NOT BE CHANGED. MAKE DIPPER TRIP LEVER ADJUSTMENT BY METHOD SHOWN, LEAVING SPRING ADJUSTMENT UNDISTURBED.



ME 3810-288-12/3-19

Figure 3–19. Dipper trip cable adjustment.

Replacement. The operator must service and replace the buckets as described below.

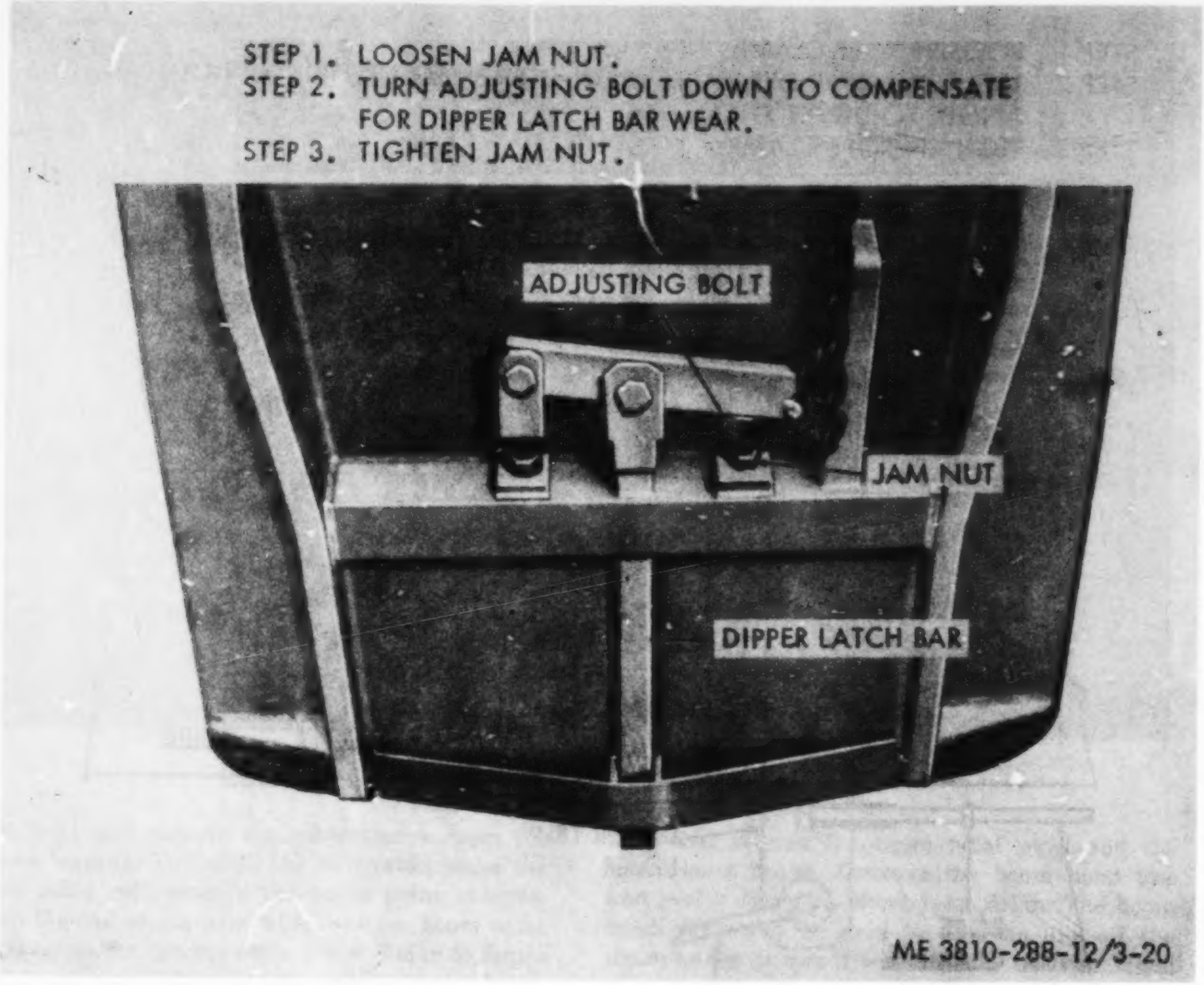
(1) *Service*. The bucket must be kept clean. Keep wear points lubricated in accordance with the lubrication order.

(2) *Replacement*. Bucket teeth must be replaced when they reach one third of their original length. Dragline teeth can be reversed, top for bottom, to equalize wear and keep them sharp during operation. Refer to figure 3–25 and replace bucket teeth.

(3) *Clamshell bucket replacement*. Refer to paragraph 2–6 and replace the clamshell bucket.

(4) *Dragline bucket replacement*. Refer to paragraph 2–7 and replace the dragline bucket.

g. Tagline Service, Adjustment, and Replacement. Operator's service, adjustment, and replace-


STEP 1. LOOSEN JAM NUT.
STEP 2. TURN ADJUSTING BOLT DOWN TO COMPENSATE FOR DIPPER LATCH BAR WEAR.
STEP 3. TIGHTEN JAM NUT.

ME 3810-288-12/3-20

Figure 3-20. Dipper latch bar adjustment.

ment procedures for the tagline are as follows:

(1) *Service.* The tagline winder must be kept clean. It must be lubricated in accordance with the lubrication order. Be sure the level of lubricant is checked at least semi-annually.

(2) *Adjustment.* The tagline must be capable of providing sufficient tension to keep the bucket from turning and fouling the clamshell hoisting and closing lines. The approximate tension required on this tagline is 195 pounds. To increase tension, pull the cable out enough to allow an additional wrap on the cable drum. The amount of tension can be varied to suit individual operator preference. The recommended tension is from two to four wraps on the tagline drum.

(3) *Replacement.* The tagline winder is mounted to the crane boom as shown in figure 2-16. Mount the tagline winder at the tip of the boom base section so that a line drawn through the cable drum lines up with the boom point.

h. Fairlead Service and Replacement.

(1) *Service.* Lubricate the fairlead with the type of lubricant listed in the lubrication order, at the interval listed. Inspect for excessive grooving of the fairlead sheaves or rollers, and report any deficiency to higher authority.

(2) *Replacement.* The fairlead is mounted on a bracket located on the front of the revolving frame. Refer to figure 2-17 and remove or replace the fairlead.

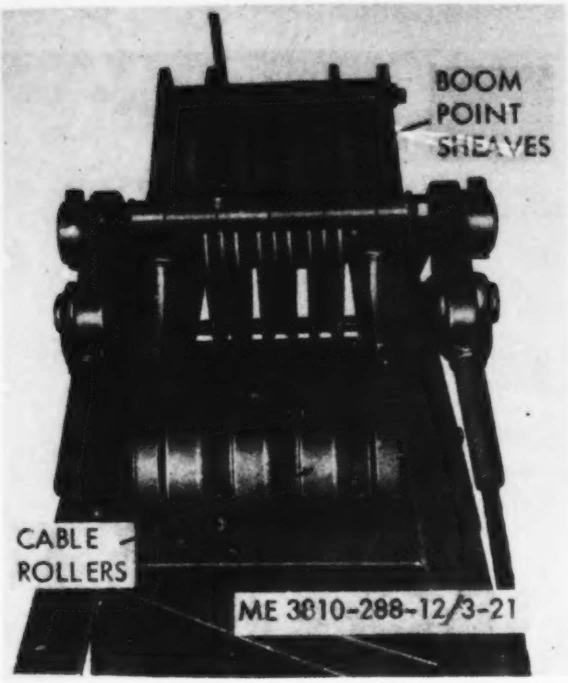


Figure 3-21. Cable roller and boom point sheave service.

3-29. Backhoe Attachment

a. Service. Installation and reeving of the backhoe attachment is covered in paragraph 2-9. Keep the backhoe attachment lubricated in accordance with the lubrication order. When the attachment is not in use, it should be placed on wooden blocks, if possible, and should be cleaned, using a cleaning solution. All machined or finished surfaces must be kept lubricated as required to prevent rust.

b. Dipper Tooth Replacement. Dipper teeth must be replaced when they are worn to about one third their original length. Refer to figure 3-25 and replace dipper teeth.

3-30. Piledriver Attachment

a. Service. Keep the piledriver attachment clean and lubricate in accordance with the lubrication order.

b. Replacement. Refer to paragraph 2-8 and replace the piledriver attachment.

3-31. Cables, Inspection, Service, and Adjustment

a. Inspection. Inspect all cables used for boom or load handling daily. The inspection is intended to determine whether the cable is suitable for further use. The recommended method is to determine the degree of damage at the worst rope lay. By definition, a rop lay is the distance along the rope in which one strand makes one complete turn around the rope. Any of the following conditions should cause the operator to replace the cable or to give consideration to replacing the cable.

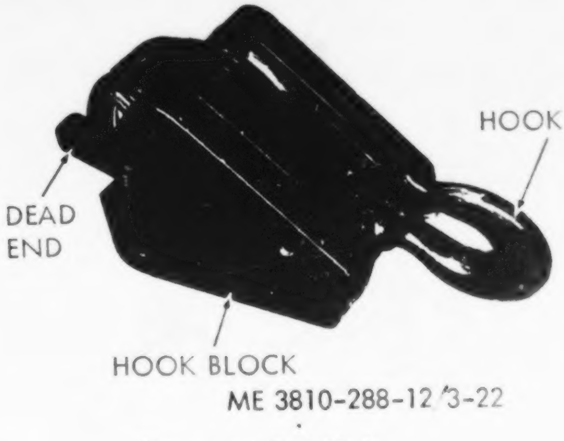


Figure 3-22. Hook block.

(1) If the core shows through more than one pair of strands.

(2) If kinking damage is severe.

(3) If there is evidence of improper lubrication combined with other defects.

(4) If the cable has come into contact with an electrical circuit or has been overheated in some other manner.

(5) If there is a serious reduction in rope size.

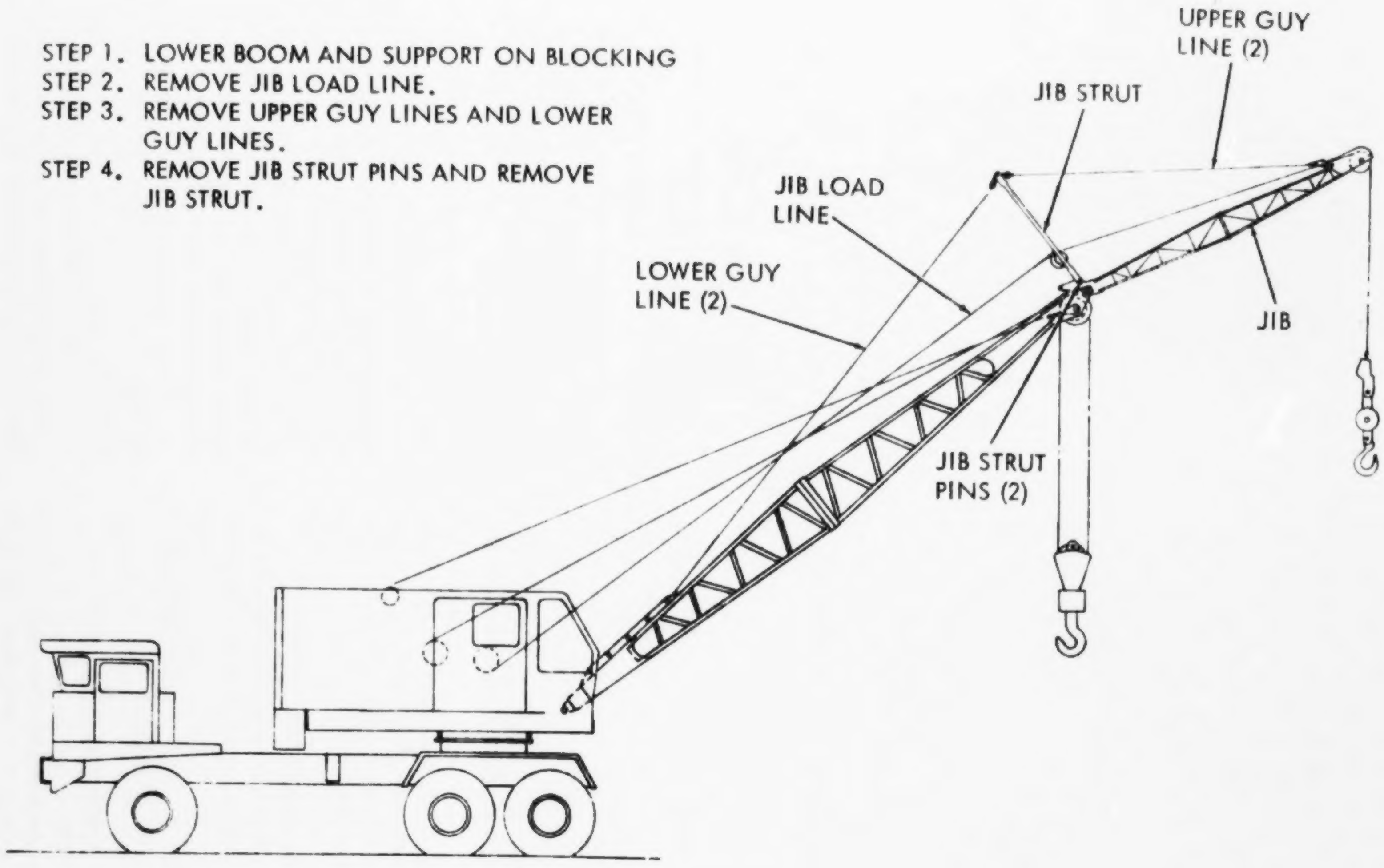
(6) If there is evidence of "bird-caging". This condition of suddenly increased size is usually caused by the sudden release of a heavy load while the cable is twisted.

(7) Broken wires at the dead end (tied down end) of a cable are cause for cutting off a section. Cut at least three feet beyond the broken wires. Then refasten or resocket the rope.

(8) If there are numerous broken wires, or as many as three adjacent broken wires in one rope lay.

(9) If corrosion or rust damage is apparent.

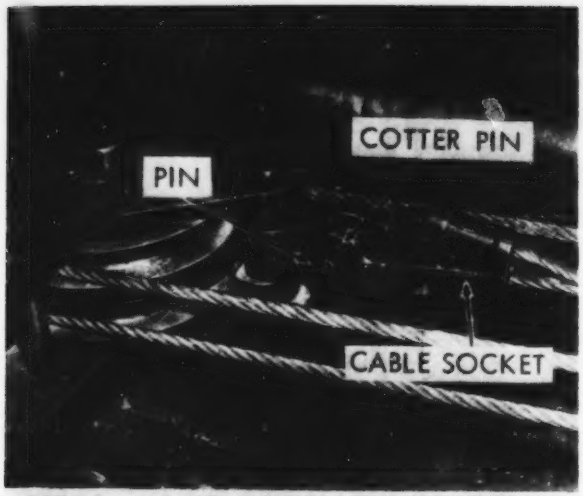
b. Service. Normal service for cables is to keep them clean, using a wire brush, scraper, or com-


UPPER GUY LINE (2)
JIB STRUT
JIB LOAD LINE
LOWER GUY LINE (2)
JIB
JIB STRUT PINS (2)

STEP 1. LOWER BOOM AND SUPPORT ON BLOCKING
STEP 2. REMOVE JIB LOAD LINE.
STEP 3. REMOVE UPPER GUY LINES AND LOWER GUY LINES.
STEP 4. REMOVE JIB STRUT PINS AND REMOVE JIB STRUT.

ME 3810-288-12/3-23

Figure 3-23. Jib and jib strut, removal and replacement.



STEP 1. LOWER BOOM TO SUITABLE SUPPORT.
STEP 2. ENGAGE BOOM HOIST PAWL.
STEP 3. REMOVE COTTER PIN AND PIN.
STEP 4. REMOVE CABLE SOCKET AND PLACE ON NEW CABLE.
STEP 5. INSTALL PIN AND COTTER PIN.

ME 3810-288-12/3-24

Figure 3-24. Boom hoist cable lower spreader connection, removal and replacement.

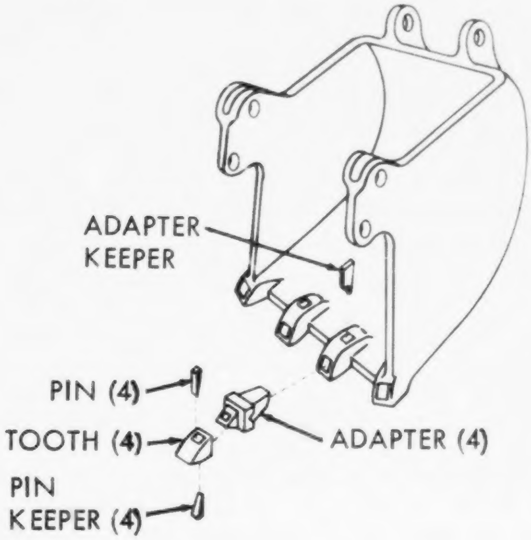
pressed air. After the cable is clean, it should be lubricated with OE every 50 hours of operation.

c. Adjustment. Adjustment of cables consists of cutting to proper length. When cutting cable, seizings must be placed on each side of the point where the cable will be cut. On preformed cable, one seizing on each side of the cut is enough. On non-performed cable less than 7/8 inch in diameter, two seizings are to be used. On non-preformed cable over 7/8 inch in diameter, three seizings are recommended. Use abrasive cutting tools, wire cutters or blade action tools, or flame cutters.

3–32. Fire Extinguisher

a. Inspection. Every six months inspect the fire extinguisher to ensure that it is full and that the seal is not broken. See that the weight of the contents is within 1/4 pound of the limits shown on the fire extinguisher.

STEP 1. DRIVE OUT PIN AND PIN KEEPER.
STEP 2. INSTALL NEW TEETH.
STEP 3. IF NECESSARY, DRIVE OUT ADAPTER KEEPER AND ADAPTER AND REPLACE.



ME 3810-288-12/3-25

Figure 3-25. Bucket teeth, removal and replacement.

b. Replacement. Replace fire extinguishers which have been used, the seals of which have been broken, or which have lost weight of 1/4 pound or more, with a like serviceable item.

Section V. TROUBLESHOOTING

3-33. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the crane (upper) portion of the Model M320T truck crane and its components. Malfunctions which may occur are listed in table 3-2. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause. Any trouble beyond the scope of organizational maintenance shall be reported to direct support maintenance.

Table 3-2. Troubleshooting

Malfunction	Probable cause	Correction action
1. Engine will not crank.	*a.* Batteries discharged or cables loose or corroded.	*a.* Replace batteries (para 3-49) or clean and tighten cables (para 3-7).
	b. Faulty starter relay	*b.* Refer to paragraph 3-49 and replace relay.
2. Engine will not start	*a.* Out of fuel.	*a.* Fill fuel tank (para 3-13).
	b. Restricted air intake.	*b.* Service air cleaner (para 3-9).
	c. Improper ignition.	*c.* Service distributor.
	d. Engine misfires.	*d.* Replace damaged wiring or spark plug.
	e. Improper valve clearance.	*e.* Adjust valves.
	f. Defective batteries	*f.* Replace or recharge
	g. Low temperature	*g.* Use cold weather starting aid.
3. Engine overheats.	*a.* Radiator coolant level low.	*a.* Add coolant (para 3-8).
	b. Engine oil level low.	*b.* Add oil (para 3-11).
	c. Water pump V-belt loose.	*c.* Adjust belt (para 3-49).
	d. Water pump faulty.	*d.* Replace water pump (para 3-48).
	e. Rain shutters closed	*e.* Open rain shutters (fig. 2-14).
	f. Collapsed hose or loose connection.	*f.* Check condition of coolant hose, tighten loose connection.
	g. Defective thermostat.	*g.* Replace.
4. Low oil pressure.	*a.* Oil too light or diluted.	*a.* Drain crankcase and refill with correct oil.
	b. Oil level low.	*b.* Add oil (para 3-11).
	c. Oil filter clogged.	*c.* Change oil filters (para 3-41)
	d. Faulty oil pressure sender.	*d.* Refer to (para 3-41) and replace oil pressure sender.
5. Batteries discharge with with engine runing.	*a.* Faulty alternator.	*a.* Repair or replace alternator (para 3-49).
	b. Alternator V-belt loose.	*b.* Adjust V-belt tension (para 3-49).
	c. Alternator brushes worn.	*c.* Replace alternator (para 3-49) or refer to proper authority.
	d. Loose connections.	*d.* Inspect wiring and tighten loose connections (para 3-7).
6. Excessive oil consumption.	*a.* Oil leaks.	*a.* Check oil lines and righten loose lines (para 3-41).
	b. Poor quality or wrong grade oil for weather.	*b.* Refer to lubrication order.

Table 3-2. Troubleshooting—Continued

Malfunction	Probable cause	Correction action
7. Lights fail.	*a.* Defective or burned out lamps. *b.* Short in wiring. *c.* Defective switch. *d.* Loose connections.	*a.* Replace lamps (para 3-49) *b.* Replace wiring (para 3-49). *c.* Replace switch (para 3-49) *d.* Tighten connections (para 3-49)
8. Lights dim.	*a.* Lens dirty. *b.* Faulty ground.	*a.* Clean lens. *b.* Clean ground terminal.
9. Revolving frame will not swing.	*a.* Swing clutch improperly adjusted *b.* Swing brake engaged. *c.* Swing lock engaged. *d.* Swing shaft broken.	*a.* Adjust swing clutch (para 3-22). *b.* Disengage swing brake (para 2-14). *c.* Disengage swing lock (fig. 2-36). *d.* Refer to direct or general support maintenance.
10. Revolving frame teeters.	Hook rollers improperly adjusted.	Adjust hook rollers (para 3-68).
11. Crane will not lift rated capacity.	*a.* Front or rear drum clutch slips. *b.* Engine not delivering full power. *c.* Some mechanical item binding in power transmission system	*a.* Adjust clutch (para 3-19 and 3-20). *b.* Refer to direct or general support maintenance. *c.* Refer to direct or general support maintenance.
12. Cables flatten out or wear excessively.	*a.* Cable improperly spooled on drum. *b.* Sheaves seized on shafts. *c.* Cable out of sheave. *d.* Cable clamps or sockets incorrectly installed.	*a.* Pay out cable and respool properly (para 3-28). *b.* Loosen sheaves and lubricate per lubrication chart. *c.* Place cable in sheave. *d.* Install so the loaded side presents a straight line pull through the eye of the socket.
13. Boom will not raise.	*a.* Boom hoist clutch slips. *b.* Boom hoist mechanical component failure. *c.* Boom already in highest position.	*a.* Adjust boom hoist clutch (para 3-21). *b.* Report to direct or general support maintenance. *c.* Lower boom.
14. Boom will not lower.	*a.* Boom supported on safety pawl. *b.* Friction shoes for boom hoist planetary pawls improperly adjusted.	*a.* Lift boom slightly, disengage pawl and lower boom. *b.* Adjust boom hoist planetary pawls (para 3-56).
15. Hard lever or pedal operation or excessive play.	*a.* Incorrect adjustment. *b.* Lack of lubrication.	*a.* Adjust correctly (para 3-26). *b.* Lubricate. See lubrication order.
16. Clamshell operates erractically.	*a.* Rear drum brake dragging. *b.* Clutches slipping or grabbing. *c.* Bucket hinges not lubricated.	*a.* Adjust rear drum brake (para 3-62). *b.* Adjust front and rear drum clutches (para 3-19 and 3-20). *c.* Lubricate hinges per lubrication order.

Table 3-2. Troubleshooting—Continued

Malfunction	Probable cause	Correction action
17. Dragline not operating properly.	*a.* Dump cable not adjusted properly.	*a.* Shorten or lengthen dump cable until proper operation is obtained.
	b. Front or rear drum brake improperly adjusted.	*b.* Adjust brake (para 3-23).
	c. Fairlead rollers or sheaves sticking.	*c.* Lubricate per lubrication order.
18. Shovel not operating properly.	*a.* Dipper pitch brace improperly adjusted for material being moved.	*a.* Adjust pitch brace (para 3-27).
	b. Front or rear drum brake improperly adjusted.	*b.* Adjust brakes (para 3-23).
19. Backhoe not operating properly.	*a.* Incorrect dipper pitch.	*a.* Adjust dipper pitch (para 3-29).
	b. Cable out of sheave.	*b.* Place cable in sheave.
	c. Front or rear drum brake improperly adjusted.	*c.* Adjust brakes (para 3-23).
20. Pile driver not operating properly.	*a.* Hammer binding on pile leads.	*a.* Lubricate the hammer per lubrication order.
	b. Front or rear drum brakes slipping.	*b.* Adjust brakes (para 3-23).
21. Engine lacks power.	*a.* Fuel pump not operating properly.	*a.* Replace fuel pump (para 3-42).
	b. Sediment bowl clogged.	*b.* Service sediment bowl (para 3-10).
	c. Air cleaner clogged.	*c.* Clean air cleaner (para 3-9).

Section VI. FIELD EXPEDIENT REPAIRS

3-34. General

Operating difficulties may occur in the field at a time when it is imperative that the machine be continued in service and when repair parts or supplies are not available for normal corrective action. The following expedient repairs may be used during such emergencies, upon authorization of the unit commander. Equipment so repaired must be removed from operation as soon as possible, and properly repaired before being returned to operation.

Table 3-3. Field Expedient Repairs

Operating difficulty	Probable cause	Field expedient repair
1. Engine will not crank.	*a.* Batteries dead.	*a.* Use jumper cables from the batteries of another piece of equipment which operates off a 24 volt system. Be sure to connect the plus (+) and minus (−) terminals of the batteries together. Never connect (+) to (−).
	b. Terminals corroded.	*b.* Clean terminals.
2. Engine overheats.	Low fluid level in radiator due to leaks.	Tape leaky hose or use a commercial "stop-leak" compound in the radiator.

Table 3-3. Field Expedient Repairs—Continued

Operating difficulty	Probable cause	Field expedient repair
3. Fuel, oil, or other fluid leaks.	Lines cracked or perforated.	Take leaking area of line until defective line can be replaced.
4. Engine will not start.	*a.* Fuel sediment bowl completely clogged.	*a.* Remove sediment bowl and blow out lines and bowl with compressed air.
	b. Air cleaner so clogged it cannot be cleaned.	*b.* Remove air cleaner output hose and operate without air cleaner.
5. Engine overheats and oil temperature is too high.	Engine oil filter elements clogged.	Remove filter elements and operate without.

Section VII. RADIO INTERFERENCE SUPPRESSION

3–35. Definitions

a. Interference. The term "interference" as used in this manual applies to electrical disturbances in the radio frequency range, which are generated by the Model M-320-T truck crane, and which may interfere with the proper operation of radio receivers or other electronic equipment.

b. Interference Suppression. The term "interference suppression" as used in this manual applies to the methods used to eliminate or effectively reduce the radio interference generated by the Model M-320-T truck crane.

3–36. General Methods of Suppression

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition and high frequency wires, grounding to the frame with bonding straps, and using capacitors and resistors.

3–37. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function is to suppress radio interference. These components are located in figure 3-26.

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary function. Figure 3-26 also illustrates secondary suppression components of both the upper and the carrier.

3–38. Replacement of Suppression Components

Refer to figure 3-26 and replace the radio interference suppression components.

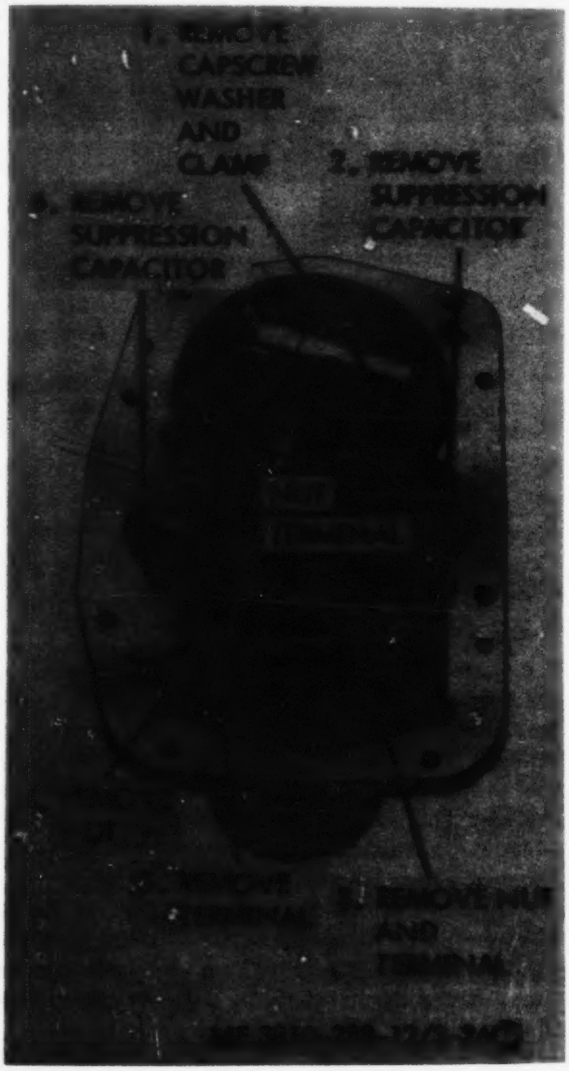

1. REMOVE CAPSCREW WASHER AND CLAMP
2. REMOVE SUPPRESSION CAPACITOR
REMOVE SUPPRESSION CAPACITOR
REMOVE TERMINAL
3. REMOVE NUT AND TERMINAL

Figure 3-26. Interference suppression components, location, removal, and installation. (Sheet 1 of 2)

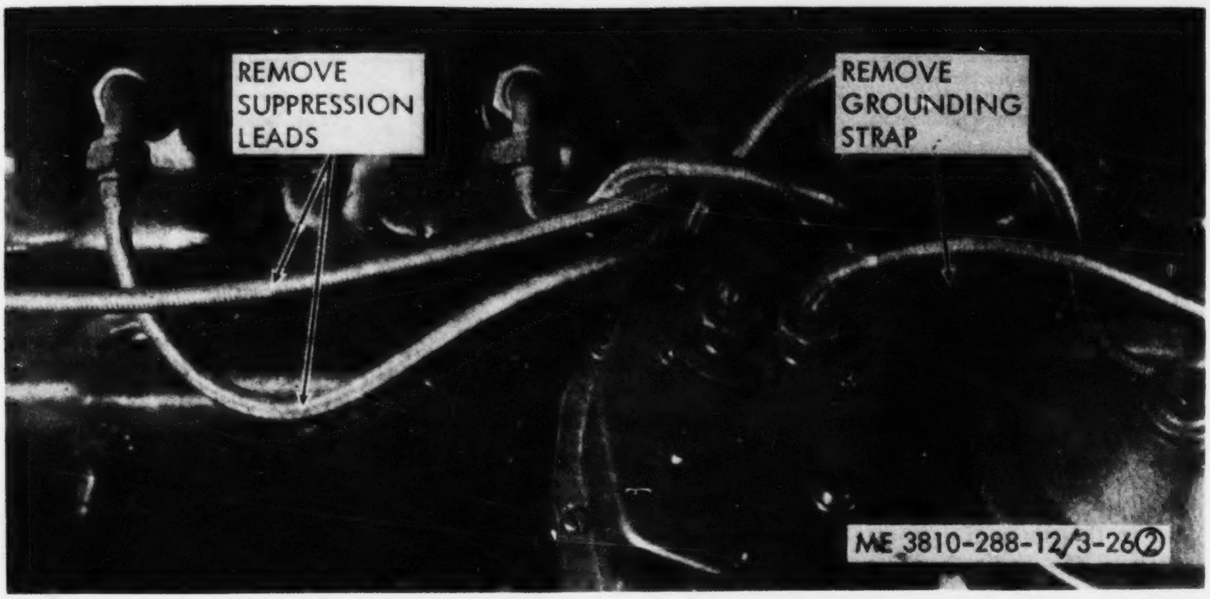


Figure 3-26. Interference suppression components, location, removal and installation. (Sheet 2 of 2)

3-39. Testing of Radio Interference Suppression Components

Test capacitors for leaks and shorts on a capacitor tester: replace defective capacitors. If test equipment is not available and interference is indicated, isolate the cause of interference by the trial-and-error method of replacing each capacitor or interference suppression component in turn until the cause of interference is located and eliminated.

Section VIII. ORGANIZATIONAL MAINTENANCE PROCEDURES

3-40. General

The maintenance procedures allocated to organizational level personnel are described in this section. The procedures are grouped according to machine function, beginning with those procedures having to do with the engine.

3-41. Engine Oil System

a. General. The engine oil system consists of the supply of oil contained in the engine crankcase, and the oil pump, filters, tubing, temperature sensing device, the dipstick, and the openings in the crankcase through which oil is added or drained. The purpose of the system is to maintain adequate lubrication of the engine.

b. Oil Filter Service and Replacement.

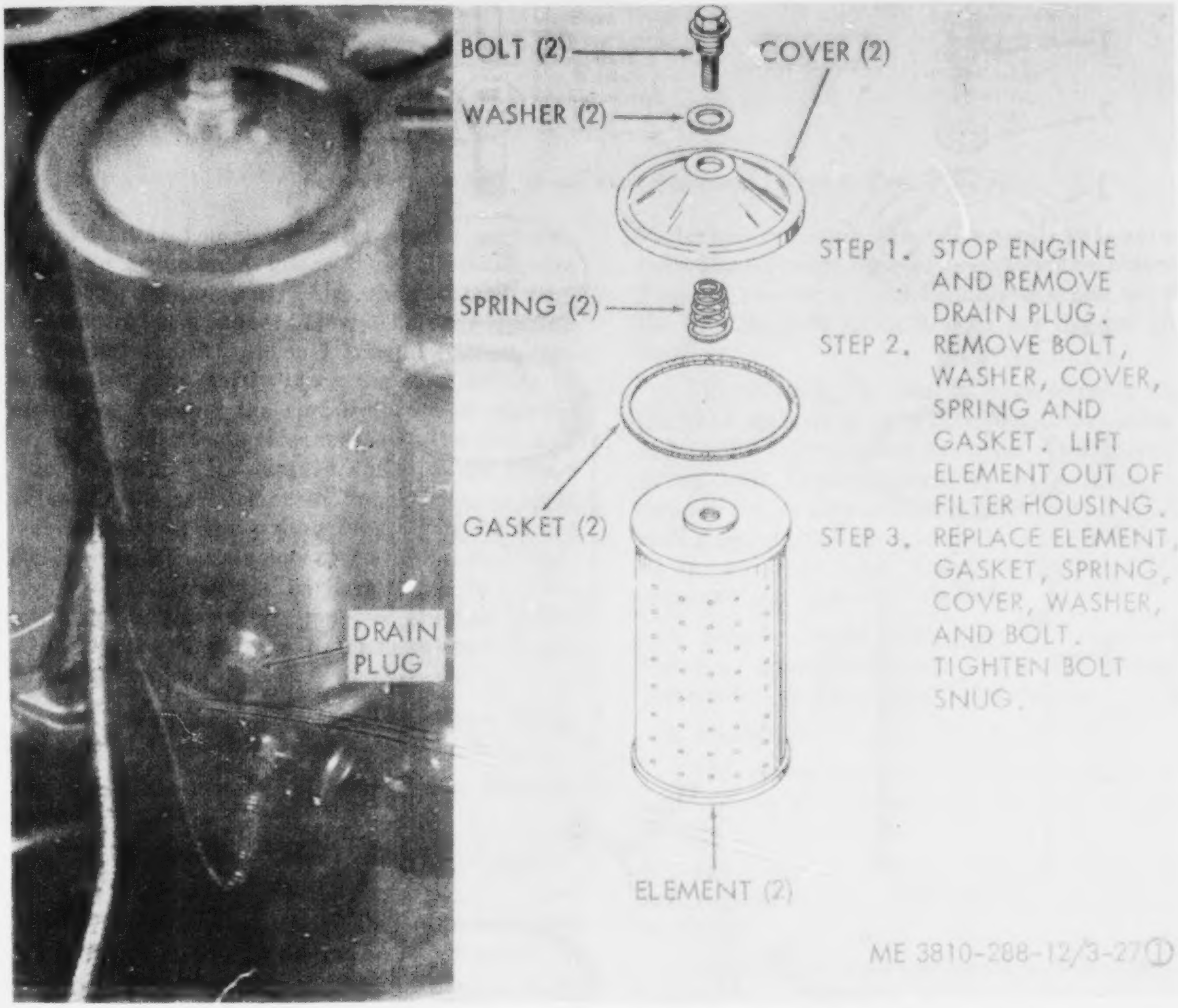
(1) *Service.* Inspect the exterior of the oil filter for leaks or visible signs of damage. Clean the filter housings and tighten any loose connections. Refer to figure 3-27 and service the oil filters.

(2) *Replacement.* To replace the entire oil filter as a unit, refer to figure 3-27, the exploded view portion, and proceed as follows: With the oil drained as described in (1) above, remove capscrews (24) and (21) and lockwashers (22) so that oil line (23) and gaskets (16) may be removed. Then remove mounting capscrews (18, 20, and 25) and lockwashers (17). The entire oil filter may now be removed as an assembly.

c. Oildex Filter Service and Replacement.

(1) *Service.* Failure to service the Oildex filter will leave the engine without effective ventilation of the crankcase. The intake manifold will have what amounts to a leak if the valve in the cover sticks open. Sludging, varnish, gum formation, and external oil leaks may develop, and spark plugs will foul rapidly. Wash components of the Oildex filter with a solvent when replacing filter elements or servicing the unit. Refer to figure 3-28 and service the Oildex filter.

(2) *Replacement.* The Oildex filter can be replaced by loosening the spring clips which secure the top cover, unscrewing the hose connections to the rear of the body assembly, and removing the two capscrews, lockwashers, and nuts which secure the mounting strap, as shown in figure 3-28.



STEP 1. STOP ENGINE AND REMOVE DRAIN PLUG.

STEP 2. REMOVE BOLT, WASHER, COVER, SPRING AND GASKET. LIFT ELEMENT OUT OF FILTER HOUSING.

STEP 3. REPLACE ELEMENT, GASKET, SPRING, COVER, WASHER, AND BOLT. TIGHTEN BOLT SNUG.

Figure 3-27. Oil filter, service and replacement. (Sheet 1 of 2)

d. External Engine Oil Lines, Replacement.

(1) *Repair.* The only repair possible to external oil lines is replacement of oil lines or flange gaskets. Refer to figure 3-29 and replace any damaged oil line or line flange gasket. Refer to paragraph 3-34, Field Expedient Repairs, for temporary emergency repairs.

(2) *Replacement.* Refer to figure 3-29 and replace damaged or unserviceable oil lines or flange gaskets.

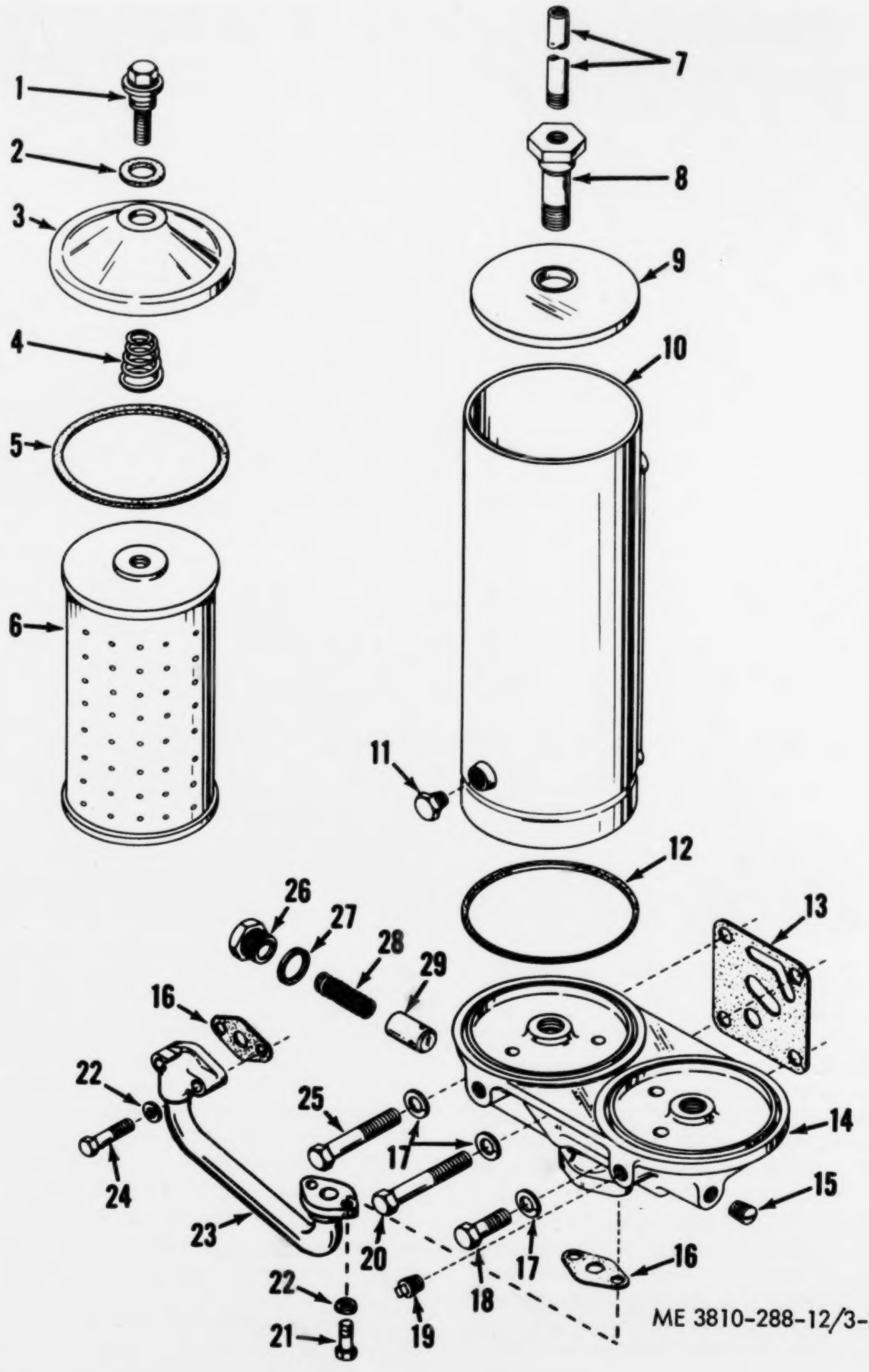
e. Oil Temperature Sender. Refer to figure 3-30 and remove and replace a faulty oil temperature sender.

3-42. Engine Fuel System

a. General. The engine fuel system consists of the fuel tank, lines, fuel pump and sediment bowl, carburetor, cold weather starting aid pump, engine governor, and other components listed in this paragraph. Organizational level maintenance authorized for the fuel system follows.

b. Carburetor Adjustment and Replacement.

(1) *Adjustment.* Carburetor adjustments must not be made before reading the following explanation. The carburetor mounting flange must be firmly mounted. The flange gasket must not leak. If a flange nut is loose, air will enter at the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1. Capscrew, cover
2. Washer
3. Cover
4. Spring
5. Gasket
6. Element
7. Pipe
8. Bushing
9. Plate
10. Housing
11. Plug
12. Gasket
13. Gasket
14. Base
15. Plug
16. Gasket
17. Washer
18. Capscrew
19. Plug
20. Capscrew
21. Capscrew
22. Washer
23. Pipe
24. Capscrew
25. Capscrew
26. Plug
27. Washer
28. Spring
29. Piston

Figure 3-27. Oil filter, service and replacement. (Sheet 2 of 2)

flange leak to completely alter engine performance. An adjustment under these circumstances can not be done properly. Also, the fuel tank must be suspected as a cause of trouble before adjusting the carburetor. An unusual amount of fuel contamination may partly block the tank outlets or fuel lines, causing the carburetor to be starved for fuel. Under these circumstances, the fuel tank must be drained and cleaned (para. 3-13) before adjusting the carburetor. If the air cleaner oil is not clean, is of the wrong type, or is filled too full it will restrict air flow to the carburetor, making it appear that the carburetor needs adjustment. All of these items must be checked before adjusting the carburetor. Refer to figure 3-31 and adjust the carburetor.

(2) *Removal and replacement.* Refer to figure 3-32 and remove and replace the carburetor.

c. Speed Governor Adjustment and Replacement.

(1) *Adjustment.* Refer to figure 3-33 and adjust the engine speed governor.

(2) *Replacement.* Refer to figure 3-34 and remove and replace the engine speed governor.

d. Fuel Pump Replacement. Refer to figure 3-35 and replace the fuel pump.

e. Fuel Sediment Bowl. The fuel sediment bowl is a portion of the fuel pump, but is treated separately because it can be serviced separately. Refer to figure 3-35 and replace the fuel sediment bowl.

f. Fuel Tanks, Lines, and Fittings.

(1) *Repair.* Clean all accessible items shown in figure 3-36 and replace any damaged items.

(2) *Replacement.* Refer to figure 3-36 and replace any damaged item.

g. Engine Throttle Control.

(1) *Adjustment.* Adjustable setscrews are located beneath the cover plate in figure 3-37. Adjust these setscrews so that the throttle lever will move through an approximate 100 degree arc, 50 degrees on either side of vertical. This adjustment should never have to be repeated or checked. Then adjust the control tension setscrew so that the throttle lever holds firm in any desired position.

(2) *Repair.* The flexible control cable from the hand throttle lever is attached at the opposite end to the engine speed governor lever. Refer to figure 3-33. Remove necessary cable clamps and remove the flexible control cable, figure 3-37. Install a new control cable. Attach to the lowest hole on the governor lever. Attach to the second hole from the end of the throttle lever.

h. Engine Choke Control Cable Replacement. Refer to figure 3-38 and replace any defective components of the engine choke control.

i. Engine Starting Aid Pump and Lines.

(1) *Pump replacement.* Refer to figure 3-38 and remove and replace the starting aid pump fittings.

(2) *Lines or fittings.* Refer to figure 3-38 and replace any damaged starting aid fuel lines or fittings.

j. Air Cleaner. Refer to figure 3-39 and replace the engine air cleaner.

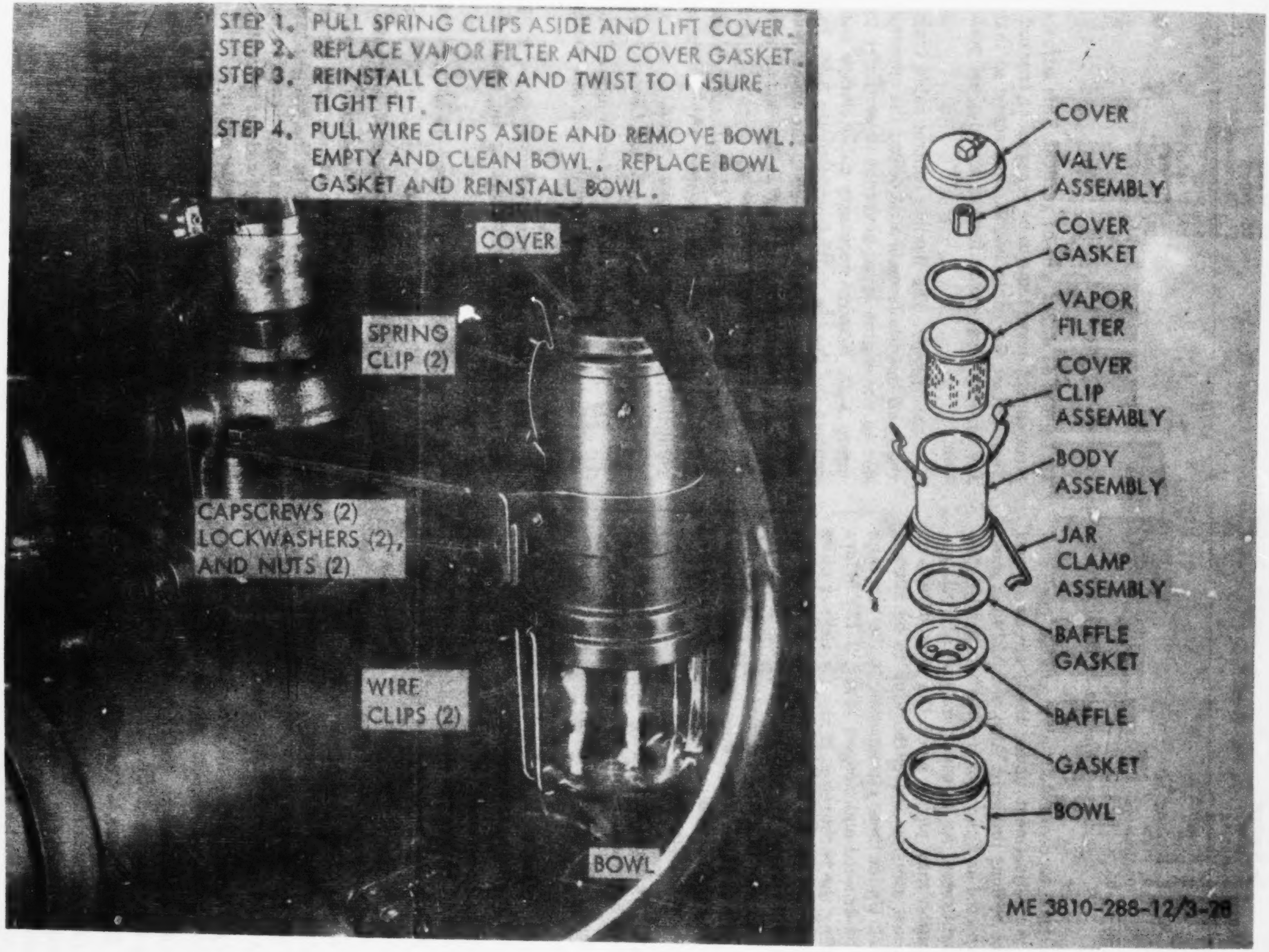
3-43. Engine Rocker Arm-Tappet Adjustment

a. General. The tappets on this engine are to be adjusted when the engine has set idle for a period of time so that it has cooled to the temperature of the surrounding air. They can not be accurately set if the rocker arms are hollowed out by contact with the valve pushrods. If inspection reveals hollowed out rocker arms, report the condition to proper authority.

b. Adjustment. Adjust as follows:

(1) Remove the spark plugs from the engine so that it can be turned to the required crankshaft positions.

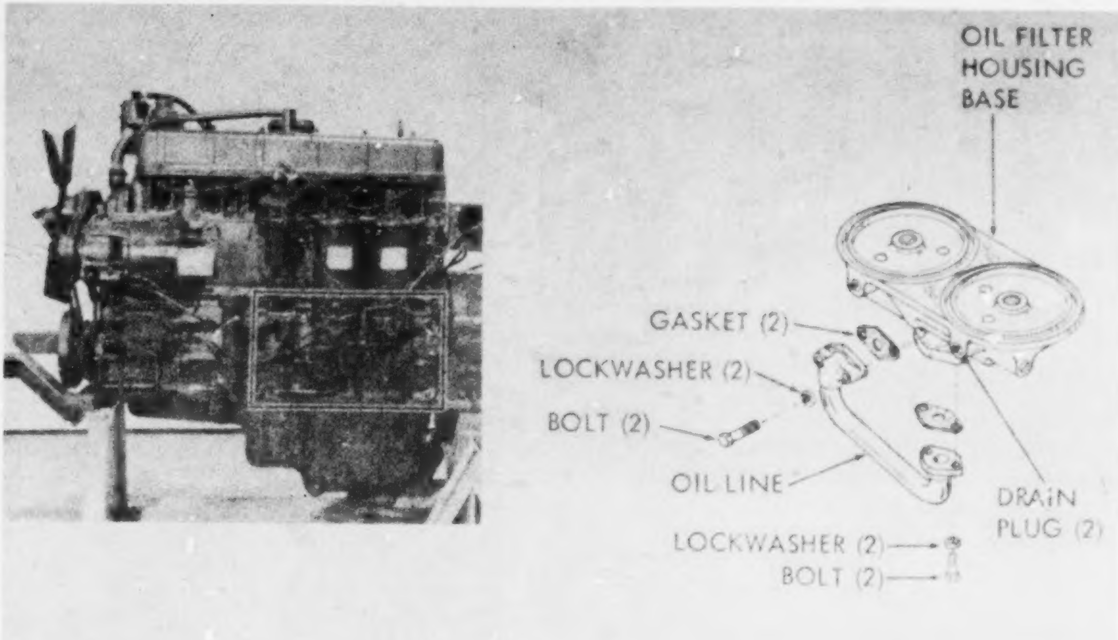
(2) Refer to figure 3-40 and remove the valve tappet cover.



STEP 1. PULL SPRING CLIPS ASIDE AND LIFT COVER.
STEP 2. REPLACE VAPOR FILTER AND COVER GASKET.
STEP 3. REINSTALL COVER AND TWIST TO INSURE TIGHT FIT.
STEP 4. PULL WIRE CLIPS ASIDE AND REMOVE BOWL. EMPTY AND CLEAN BOWL. REPLACE BOWL GASKET AND REINSTALL BOWL.

COVER
SPRING CLIP (2)
CAPSCREWS (2) LOCKWASHERS (2), AND NUTS (2)
WIRE CLIPS (2)
BOWL
COVER
VALVE ASSEMBLY
COVER GASKET
VAPOR FILTER
COVER CLIP ASSEMBLY
BODY ASSEMBLY
JAR CLAMP ASSEMBLY
BAFFLE GASKET
BAFFLE
GASKET
BOWL
ME 3810-288-12/3-28

Figure 3-28. Oildex filter, service and replacement.



STEP 1. STOP ENGINE. REMOVE OIL FILTER DRAIN PLUG AND DRAIN OIL FROM FILTER.
STEP 2. REMOVE BOLT AND LOCKWASHER. REMOVE OIL LINE AND GASKETS.
STEP 3. REPLACE GASKETS, OIL LINE, LOCKWASHERS, AND BOLTS.
STEP 4. START ENGINE AND RUN, AT LOW IDLE, FOR A FEW MINUTES. STOP ENGINE. REFER TO FIGURE 3, REFERENCE 15 AND CHECK OIL LEVEL. ADD OIL AS NECESSARY.

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Figure 3-29. External engine oil lines, repair and replacement. (Sheet 1 of 2)

(3) Insert a suitable ratchet extension into the socket in the front of the vibration damper and turn the engine over until the mark on the engine flywheel indicates that number one piston is on top dead center on the compression stroke. Refer to figure 3-29 for vibration damper location and figure 3-41 for the appearance of the top dead center mark.

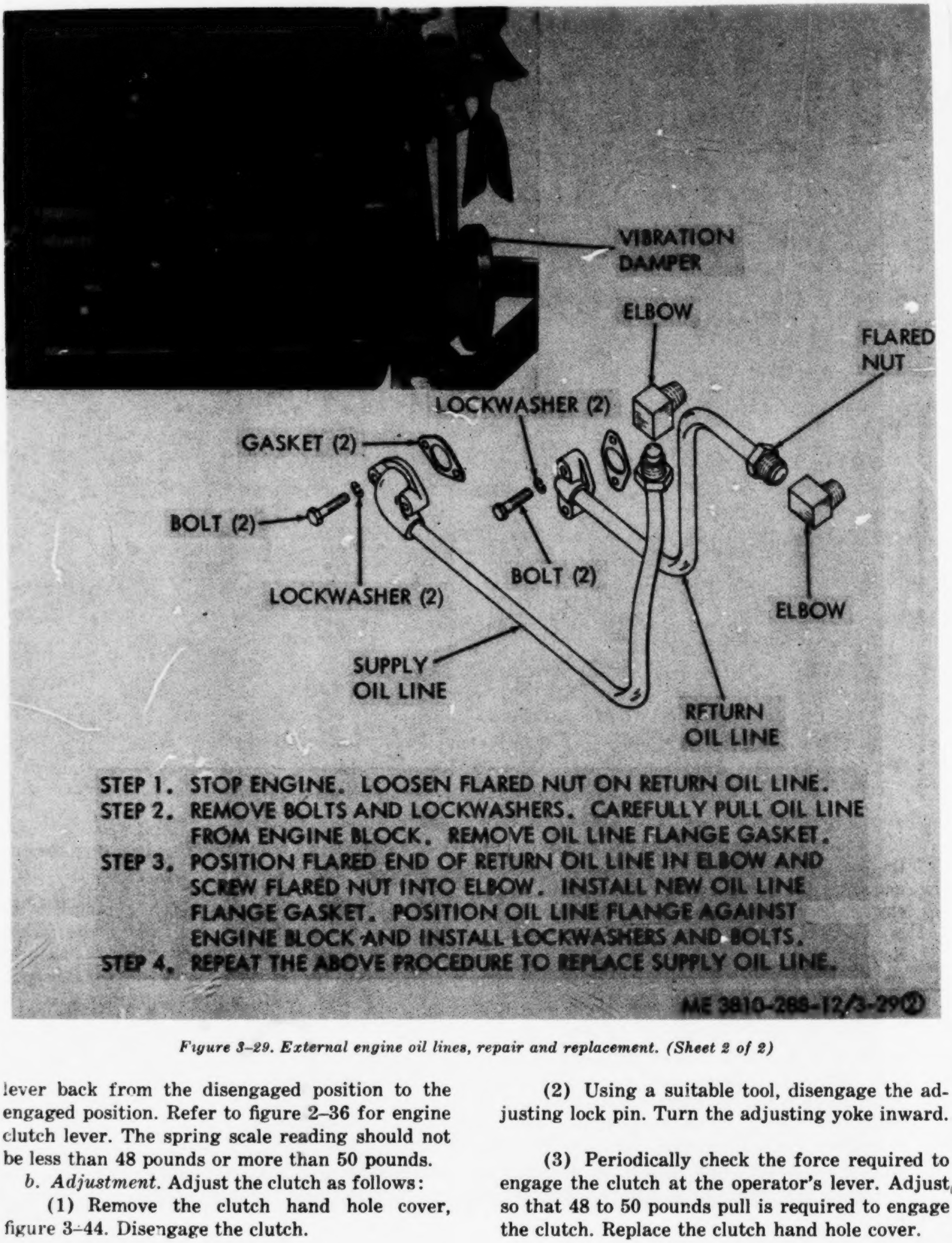
(4) The arrangement of the valves in this engine is as shown in figure 3-42. Refer to figure 3-43 and adjust the exhaust valve for cylinder number one to the clearance shown. Then adjust the intake valve to the clearance shown. Be sure to loosen the adjusting screw locknut before turning the adjusting screw, and to tighten the adjusting screw locknut before releasing the adjusting screw.

(5) Turn the engine over 120 crankshaft degrees (60 camshaft degrees) using the rachet. This will bring piston number five to top dead center on compression stroke. Repeat for each cylinder, in firing order sequence, which is 1-5-3-6-2-4.

(6) Refer to figure 3-40 and replace the valve tappet cover.

3-44. Engine Clutch

a. Inspection. Place a spring scale on the engine clutch lever in the operator's cab and pull the



STEP 1. STOP ENGINE. LOOSEN FLARED NUT ON RETURN OIL LINE.
STEP 2. REMOVE BOLTS AND LOCKWASHERS. CAREFULLY PULL OIL LINE FROM ENGINE BLOCK. REMOVE OIL LINE FLANGE GASKET.
STEP 3. POSITION FLARED END OF RETURN OIL LINE IN ELBOW AND SCREW FLARED NUT INTO ELBOW. INSTALL NEW OIL LINE FLANGE GASKET. POSITION OIL LINE FLANGE AGAINST ENGINE BLOCK AND INSTALL LOCKWASHERS AND BOLTS.
STEP 4. REPEAT THE ABOVE PROCEDURE TO REPLACE SUPPLY OIL LINE.

ME 3810-288-12/3-29②

Figure 3-29. External engine oil lines, repair and replacement. (Sheet 2 of 2)

lever back from the disengaged position to the engaged position. Refer to figure 2-36 for engine clutch lever. The spring scale reading should not be less than 48 pounds or more than 50 pounds.

b. Adjustment. Adjust the clutch as follows:

(1) Remove the clutch hand hole cover, figure 3-44. Disengage the clutch.

(2) Using a suitable tool, disengage the adjusting lock pin. Turn the adjusting yoke inward.

(3) Periodically check the force required to engage the clutch at the operator's lever. Adjust so that 48 to 50 pounds pull is required to engage the clutch. Replace the clutch hand hole cover.

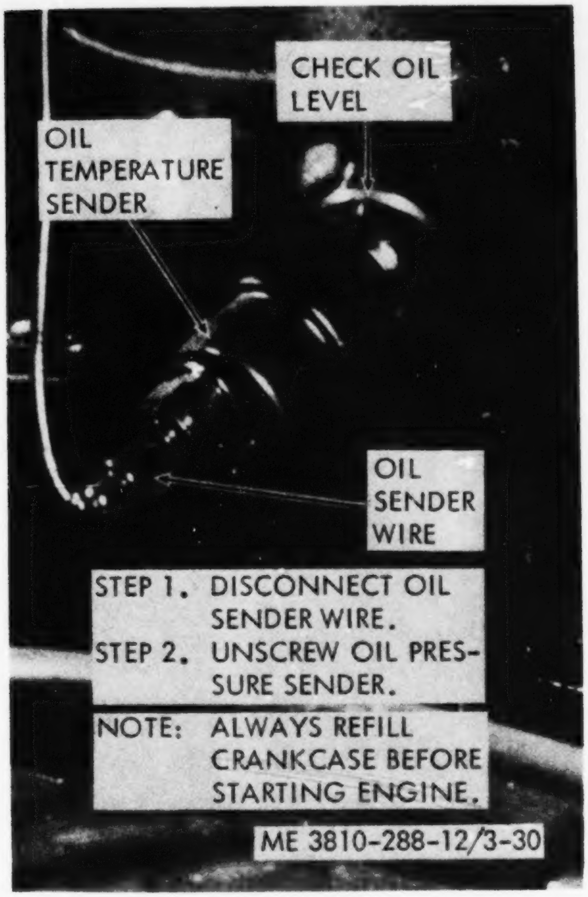

CHECK OIL LEVEL
OIL TEMPERATURE SENDER
OIL SENDER WIRE
STEP 1. DISCONNECT OIL SENDER WIRE.
STEP 2. UNSCREW OIL PRESSURE SENDER.
NOTE: ALWAYS REFILL CRANKCASE BEFORE STARTING ENGINE.
ME 3810-288-12/3-30

Figure 3-30. Oil temperature sender, removal and replacement.

3-45. Exhaust Manifold

a. Inspection. Inspect manifold for cracks, breaks, signs of deterioration around gaskets, or leaks.

b. Removal. Remove the exhaust manifold as follows:

(1) *Stop engine.* Refer to figure 3-32 and remove carburetor. Refer to figure 3-46 and remove muffler and exhaust pipe.

(2) Disconnect vent hose and starting aid fuel line from intake manifold.

(3) Refer to figure 3-45 and remove manifold nuts, washers and clamps. Remove exhaust and intake manifold from engine.

(4) Remove bolts and lockwashers from the bottom of intake manifold, and remove exhaust manifold from intake manifold.

c. Repair. Replace all gaskets and any damaged items with like servicable items. Clean all parts in an approved cleaning solvent and dry thoroughly.

d. Replacement. Replace the exhaust manifold as follows:

(1) Position gasket on intake manifold, place exhaust manifold on intake manifold, and install four bolts and four lockwashers.

(2) Position gaskets on manifold ports and install manifold on engine. Install clamps on the studs at each end of manifold and secure with manifold nuts. Install remaining manifold nuts on remaining studs.

(3) Refer to figure 3-32 and install carburetor. Refer to figure 3-46 and install muffier and exhaust pipe. Reconnect vent hose and starting aid fuel line to intake manifold.

3-46. Intake Manifold

The intake manifold is removed from the engine when the exhaust manifold is removed. Refer to paragraph 3-45 and remove the intake manifold.

3-47. Muffler and Exhaust Pipe

a. Removal. Remove the muffler and exhaust pipe as follows:

(1) Stop the engine and allow the muffler and exhaust pipe to cool. Refer to figure 3-46 and remove the bolts and nuts holding the guard to the supports.

(2) Remove the nuts, lockwashers, and muffler clamps. Remove the muffler and exhaust elbow from the exhaust pipe. Remove the capscrews, nuts, and lockwashers from the base of the exhaust pipe, and remove the exhaust and gasket.

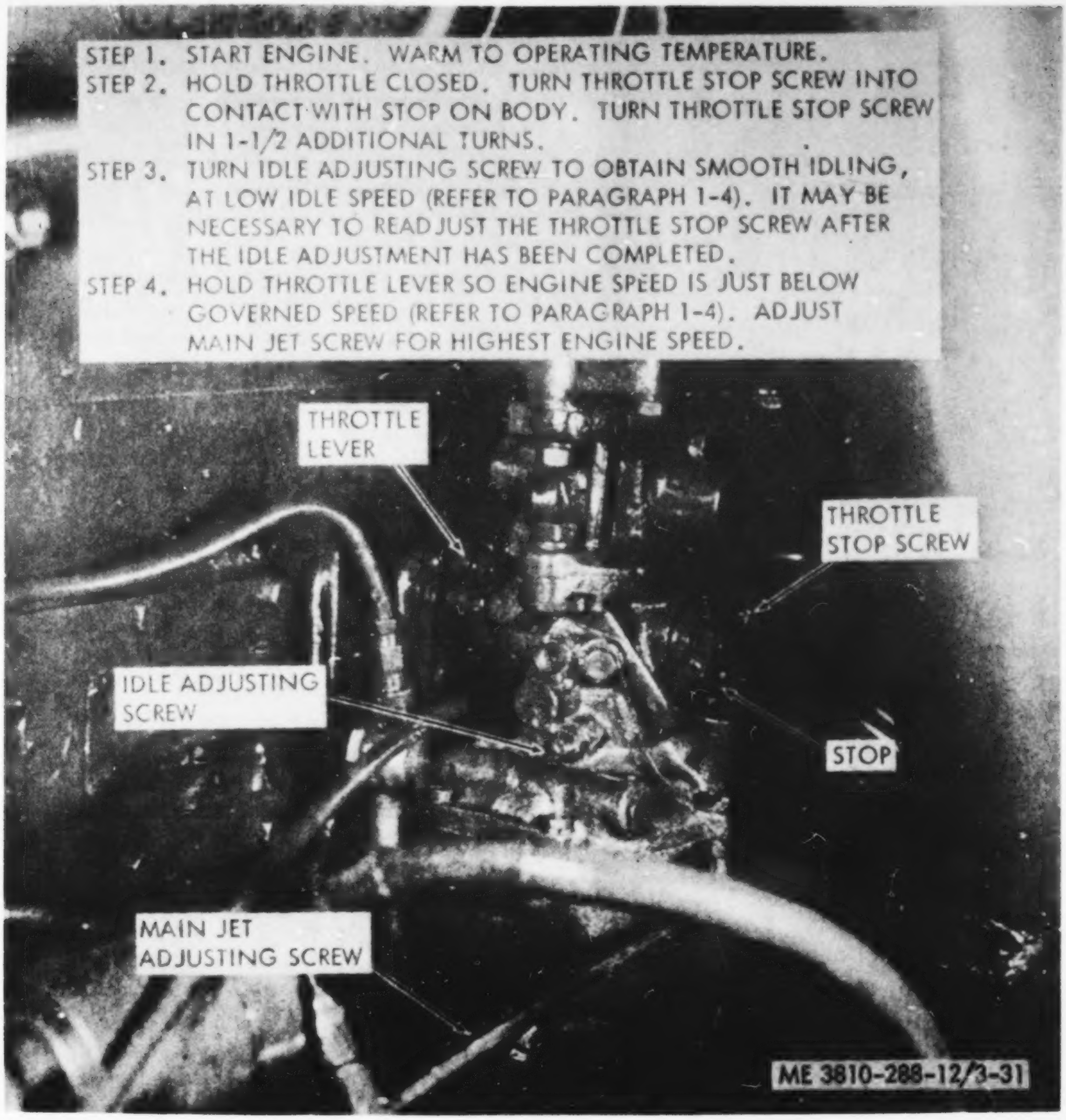
b. Replacement. Replace the muffler and exhaust pipe as follows:

(1) Install a new gasket on the exhaust manifold, place the exhaust pipe on the exhaust manifold, and secure with capscrews, nuts, and lockwashers.

(2) Install the exhaust elbow in muffler, and then install the muffler on the exhaust pipe. Install all muffler clamps. Install the guard on the supports.

3-48. Coolant System

a. General. The cooling system consists of a radiator, water pump, a thermostat, fan, and



STEP 1. START ENGINE. WARM TO OPERATING TEMPERATURE.

STEP 2. HOLD THROTTLE CLOSED. TURN THROTTLE STOP SCREW INTO CONTACT WITH STOP ON BODY. TURN THROTTLE STOP SCREW IN 1-1/2 ADDITIONAL TURNS.

STEP 3. TURN IDLE ADJUSTING SCREW TO OBTAIN SMOOTH IDLING, AT LOW IDLE SPEED (REFER TO PARAGRAPH 1-4). IT MAY BE NECESSARY TO READJUST THE THROTTLE STOP SCREW AFTER THE IDLE ADJUSTMENT HAS BEEN COMPLETED.

STEP 4. HOLD THROTTLE LEVER SO ENGINE SPEED IS JUST BELOW GOVERNED SPEED (REFER TO PARAGRAPH 1-4). ADJUST MAIN JET SCREW FOR HIGHEST ENGINE SPEED.

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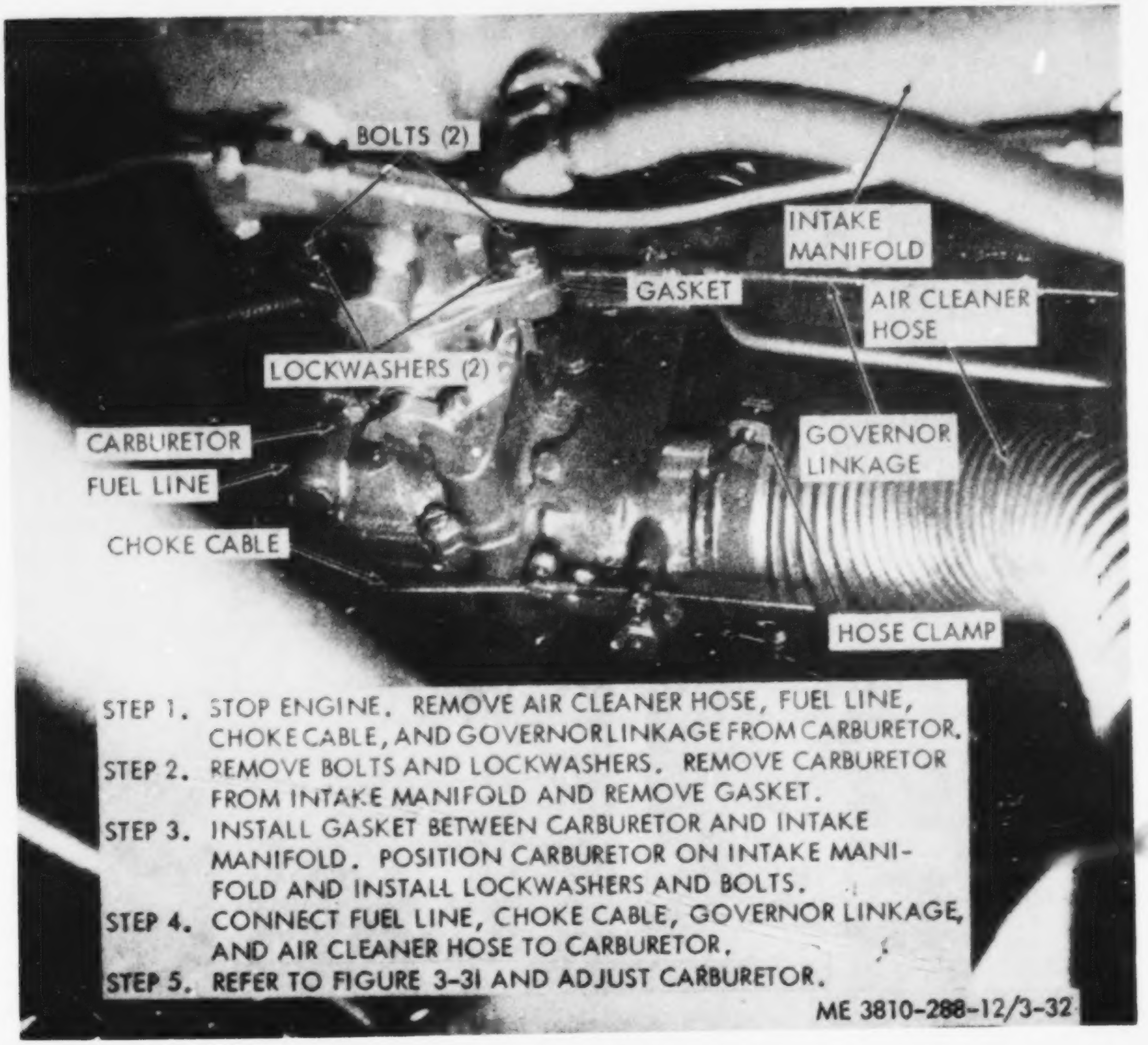
Figure 3-31. Carburetor, adjustment.

necessary lines and fittings to connect components. The thermostat regulates the flow of coolant pumped through the engine block by the pump. Drain valves are located on each side of the engine to drain the radiator and engine block.

b. Radiator and Radiator Cap.

(1) *Test.* If available, test the radiator cap on a cap pressure tester. The cap should retain 4 psi (pounds per square inch) pressure. If no cap tester is available and the cap is suspected of leaking, replace the cap.

(2) *Removal.* Before removing the radiator, open both coolant drain valves. Drain all coolant from the radiator and engine block before removing the radiator. Then, refer to figure 3-47 and remove and replace the radiator as follows.



STEP 1. STOP ENGINE. REMOVE AIR CLEANER HOSE, FUEL LINE, CHOKE CABLE, AND GOVERNOR LINKAGE FROM CARBURETOR.

STEP 2. REMOVE BOLTS AND LOCKWASHERS. REMOVE CARBURETOR FROM INTAKE MANIFOLD AND REMOVE GASKET.

STEP 3. INSTALL GASKET BETWEEN CARBURETOR AND INTAKE MANIFOLD. POSITION CARBURETOR ON INTAKE MANIFOLD AND INSTALL LOCKWASHERS AND BOLTS.

STEP 4. CONNECT FUEL LINE, CHOKE CABLE, GOVERNOR LINKAGE, AND AIR CLEANER HOSE TO CARBURETOR.

STEP 5. REFER TO FIGURE 3-31 AND ADJUST CARBURETOR.

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Figure 3-32. Carburetor, removal and replacement.

(*a*) Refer to figure 3-99 and remove radiator shutters and sheet metal as required.

(*b*) Remove upper connection hoses and hose clamps (fig. 3-47).

(*c*) Remove all fan guard capscrews and lockwashers and remove fan guard.

(*d*) Remove lower connection hoses and hose clamps.

(*e*) Remove drain line hose clamps.

(*f*) Support the radiator so it can not fall and attach a suitable lifting device.

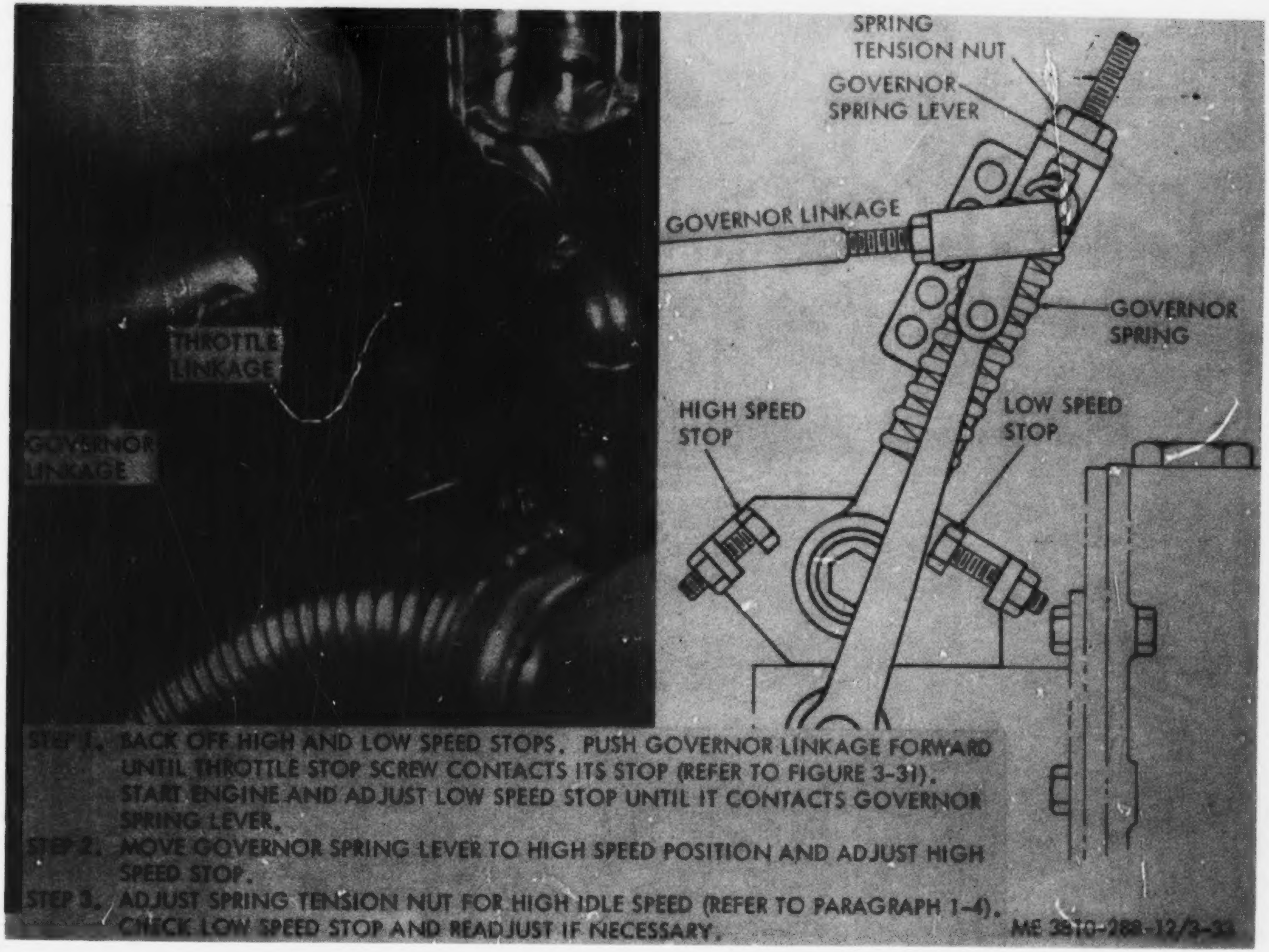
(*g*) Remove one nut and three washers from the mounting studs on each side.

(*h*) Remove radiator braces. One brace is on each side of the engine.

(*i*) Lift radiator until mounting studs clear the mounting brackets. Then remove the radiator through the rear of the cab where rain shutters and sheet metal have been removed.

c. Thermostat, Housing, Gaskets, and Lines.

(1) *Service.* Keep the thermostat housing and lines tightened so that they do not leak. Wipe

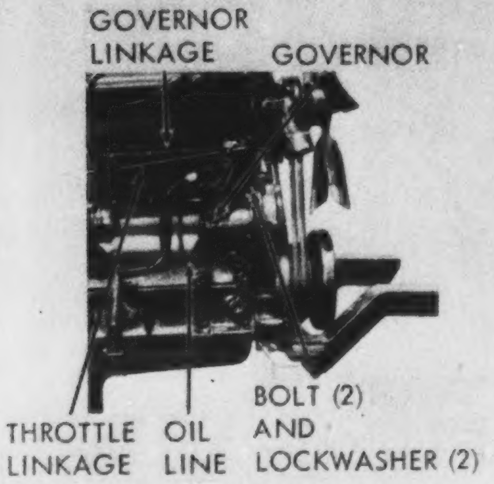

THROTTLE LINKAGE
GOVERNOR LINKAGE
SPRING TENSION NUT
GOVERNOR SPRING LEVER
GOVERNOR LINKAGE
GOVERNOR SPRING
HIGH SPEED STOP
LOW SPEED STOP
ME 3810-288-12/3-33

STEP 1. BACK OFF HIGH AND LOW SPEED STOPS. PUSH GOVERNOR LINKAGE FORWARD UNTIL THROTTLE STOP SCREW CONTACTS ITS STOP (REFER TO FIGURE 3-31). START ENGINE AND ADJUST LOW SPEED STOP UNTIL IT CONTACTS GOVERNOR SPRING LEVER.

STEP 2. MOVE GOVERNOR SPRING LEVER TO HIGH SPEED POSITION AND ADJUST HIGH SPEED STOP.

STEP 3. ADJUST SPRING TENSION NUT FOR HIGH IDLE SPEED (REFER TO PARAGRAPH 1-4). CHECK LOW SPEED STOP AND READJUST IF NECESSARY.

Figure 3-33. Engine speed governor adjustment.



STEP 1. DISCONNECT THROTTLE, GOVERNOR LINKAGE AND OIL LINE. REMOVE BOLT AND LOCKWASHERS. REMOVE GOVERNOR.

STEP 2. INSTALL GOVERNOR AND SECURE WITH BOLTS AND LOCKWASHERS. CONNECT THROTTLE AND GOVERNOR LINKAGE.

ME 3810-288-12/3-34

Figure 3-34. Engine speed governor, removal and replacement.

clean with a damp cloth. Keep the petcock (fig. 3-48) closed.

(2) *Removal.* With the engine stopped, open the petcock, figure 3-48, and drain coolant below the level of the thermostat. Refer to figure 3-47 and remove the upper connection hose attached to the top of the thermostat housing. Then proceed as follows:

(*a*) Remove bolts and lockwashers which secure the thermostat housing to the base (fig. 3-48). Note that the Oildex filter will be removed from its mounting on the thermostat housing by removing these bolts. Refer to figure 3-28.

(*b*) Remove the clamp which secure the water pump line to the thermostat housing.

(c) Remove water pump line nuts and lockwashers.

(*d*) Remove water pump line and pump line gasket.

(*e*) Remove thermostat housing and gasket.

(*f*) Remove thermostat. Do not disassemble further unless base gasket must be replaced.

(3) *Testing.* Test the thermostat for proper operation by suspending it and a thermometer in a container of water. Heat the water. When the thermometer indicates between 160 and 165 degrees Fahrenheit, the thermostat should begin to open. It should be fully open when the temperature has risen to between 185 and 190 degrees Fahrenheit. Remove the thermostat from the water when it is fully open. The cool surrounding air should now cause the thermostat to close rapidly. Replace a defective thermostat.

(4) *Repair.* No repair of a faulty thermostat is possible. It must be replaced. Replace all gaskets when disassembly has occurred. Replace faulty hoses or hose clamps.

(5) *Installation.* Refer to figure 3-48 and replace the thermostat, housing, and lines.

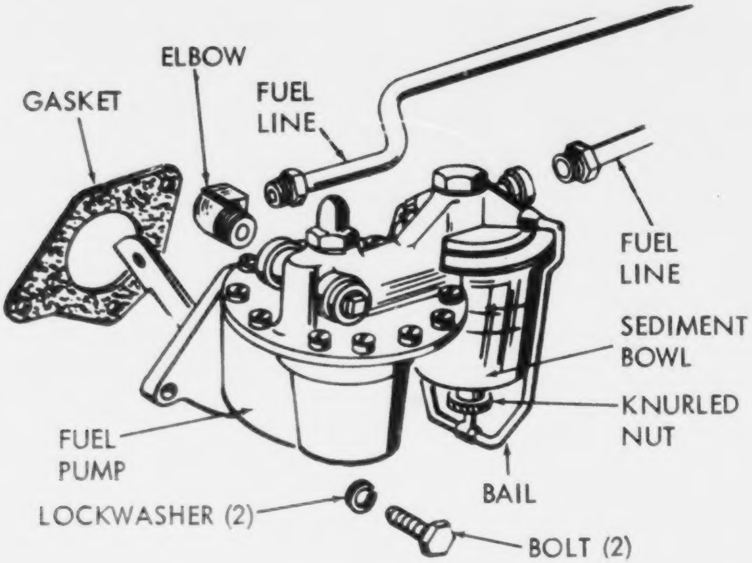
d. Water Pump. Drain the coolant system below the level of the water pump before removing the pump. Refer to figure 3-47 and remove the radiator. Refer to figure 3-51 and loosen the alternator V-belt until the belts can be removed from the water pump sheaves. Refer to figure 3-49 and remove the water pump and drive sheave.

e. Water Pump Drive Belt. The water pump drive belts also drive the alternator. Refer to paragraph 3-49 for information on water pump drive belt adjustment or replacement.

f. Water Temperature Sender. Refer to figure 3-50 and replace a faulty water temperature sender.

3-49. Electrical System

a. General. This machine uses 24 volt components. Refer to figure 1-14 for a view of the electrical system schematic diagram. The system consists of two 12 volt batteries, a magnetic switch, an alternator with internal voltage regulator, the starter motor, and other minor components as shown on the schematic diagram. The system is of the negative ground type.



STEP 1. STOP ENGINE. DISCONNECT FUEL LINES.

STEP 2. REMOVE BOLTS AND LOCKWASHERS. REMOVE FUEL PUMP WITH SEDIMENT BOWL AND GASKET FROM ENGINE.

STEP 3. POSITION FUEL PUMP ON ENGINE WITH GASKET BETWEEN PUMP AND ENGINE. INSTALL BOLTS AND LOCKWASHERS. RECONNECT FUEL LINES.

STEP 4. TO SERVICE SEDIMENT BOWL, LOOSEN KNURLED NUT AT THE BOTTOM OF BOWL, SWING BAIL ASIDE, AND REMOVE BOWL.

STEP 5. WIPE OUT SEDIMENT BOWL WITH CLEAN CLOTH. INSTALL NEW GASKET ABOVE BOWL, POSITION BOWL IN HOUSING, SWING BAIL UNDER BOWL AND TIGHTEN KNURLED NUT.

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Figure 3-35. Fuel pump and fuel sediment bowl, removal and replacement.

***Warning:* Always disconnect battery cables before working on electrical components.**

b. Alternator.

(1) *Belt adjustment.* Refer to figure 3-51 and adjust the alternator belt tension. Note that the alternator belts also drive the water pump, and that water pump belt tension is being adjusted at the same time.

(2) *Belt replacement.* Refer to figure 3-51 and replace alternator-water pump belts.

(3) *Alternator testing.* Before removing an alternator for repair or replacement, belts, mounting bracket, and wiring must be inspected for slippage, fraying, broken wiring, grounds, or other faults. After these items have been checked and found in order, an electrical check may be made, as follows:

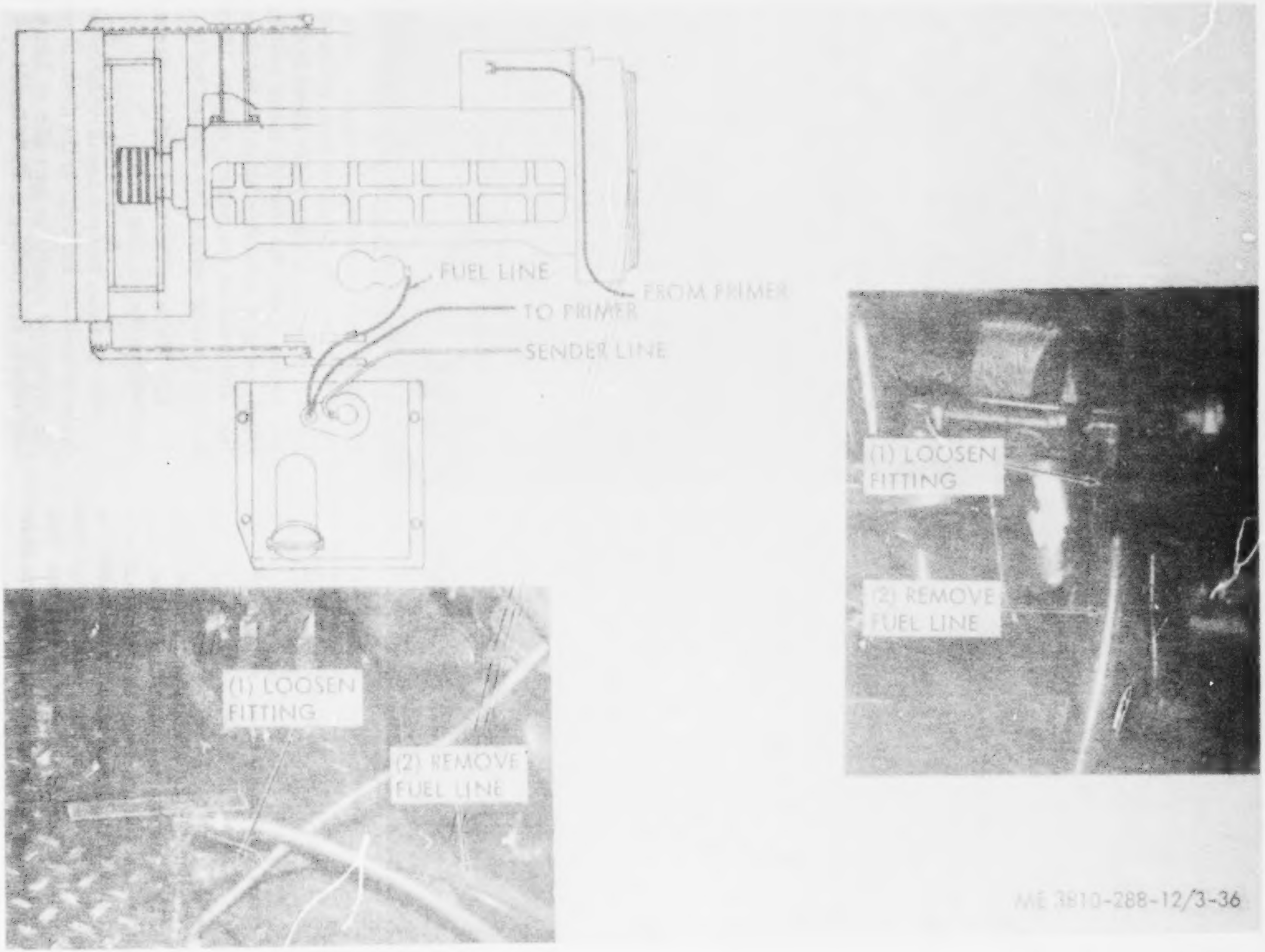

FUEL LINE
FROM PRIMER
TO PRIMER
SENDER LINE
(1) LOOSEN FITTING
(2) REMOVE FUEL LINE
(1) LOOSEN FITTING
(2) REMOVE FUEL LINE
ME 3810-288-12/3-36

Figure 3-36. Fuel tank, lines, and fittings, removal and replacement.

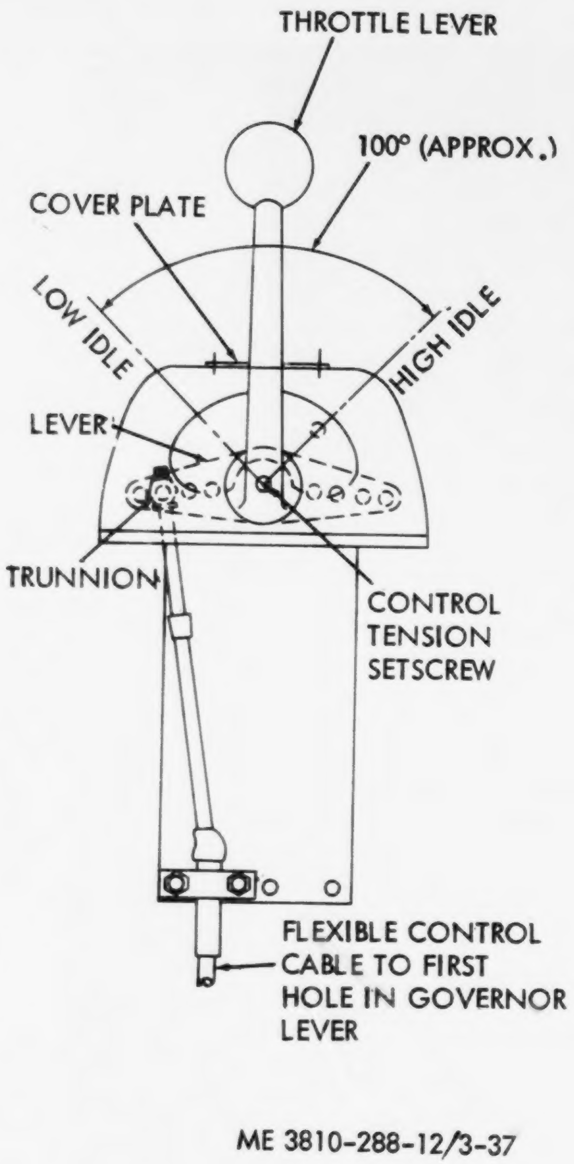


Figure 3-37. Engine throttle adjustment.

(*a*) Remove the alternator terminal cover (fig. 3-51) to expose the positive (+) terminal and check the voltage from this terminal to a ground connection. Use an accurate voltmeter set on the 50 volt dc scale for this check. The ignition switch must be turned ON during this test. Full battery voltage of 24 volts should be shown. If no voltage is indicated, an open circuit between the battery and the alternator is indicated. Check battery cables, ignition switch, and wiring.

(*b*) With the ignition switch on, but the engine NOT started, check for full battery voltage from the ignition (IGN) lead of the alternator to ground. Full battery voltage must be indicated. It will be necessary to unplug the ignition (IGN) connector and check the male side with the voltmeter probe. Full battery voltage must be present at both alternator terminals in order for the machine to function properly.

***Caution:* Do not run the alternator with its output circuit open and the ignition lead energized. This will create extremely high voltages which will seriously damage the alternator. Never attempt to polarize this alternator. Always disconnect all alternator leads if welding is to be done on this unit.**

(4) *Alternator replacement.* Refer to figure 3-51 and loosen alternator drive belts. Remove all electrical connections to the alternator. Support the alternator, remove the adjusting lock screw and remove the alternator mounting bolts, nuts, and lockwashers. Remove the alternator.

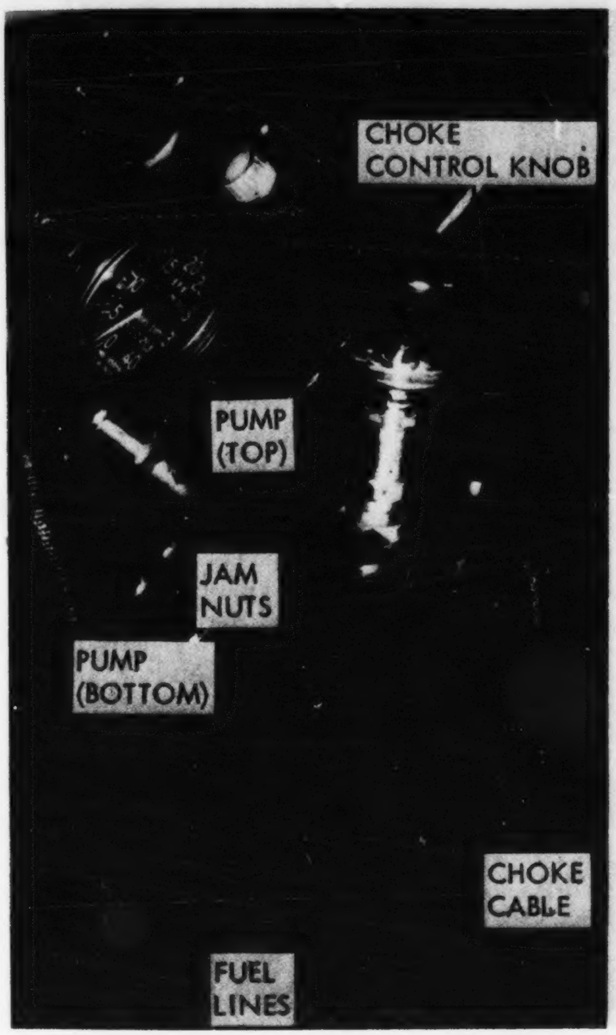
c. Starting Motor.

(1) *Motor test.* Before removing the motor make the following tests. Check the batteries (para 3-49, *j* (1)) to make sure that the batteries aer in good condition. Inspect all motor wiring for frayed insulation or other damage. Replace or repair damaged wiring. Inspect all connections to the starting motor, solenoid, magnetic switches, ignition switch, start pushbutton, and battery, including all ground connections. Clean and tighten any defective connections. If the trouble is not found, connect a jumper wire around any switch or solenoid suspected of being defective. If the system functions properly using this method, replace the defective item, or report it to proper authority. If none of the above has located the trouble, check the starting motor battery terminal, using a voltmeter adjusted for dc operation, and measure the battery voltage. If voltage is 22 to 24 volts, replace the starting motor.

(2) *Motor replacement.* Refer to figure 3-52 and remove the starting motor.

(3) *Starting motor solenoid replacement.* Refer to figure 3-52 and remove the solenoid mounting capscrews shown in part one of figure 3-52 and remove the starting motor solenoid.

(4) *Magnetic switch replacement.* The magnetic switches are treated as part of the starting



STEP 1. STOP ENGINE. REFER TO FIGURE 3-32 AND REMOVE CHOKE CABLE FROM CARBURETOR. UNSCREW JAM NUT, AND REMOVE THE CHOKE CABLE.

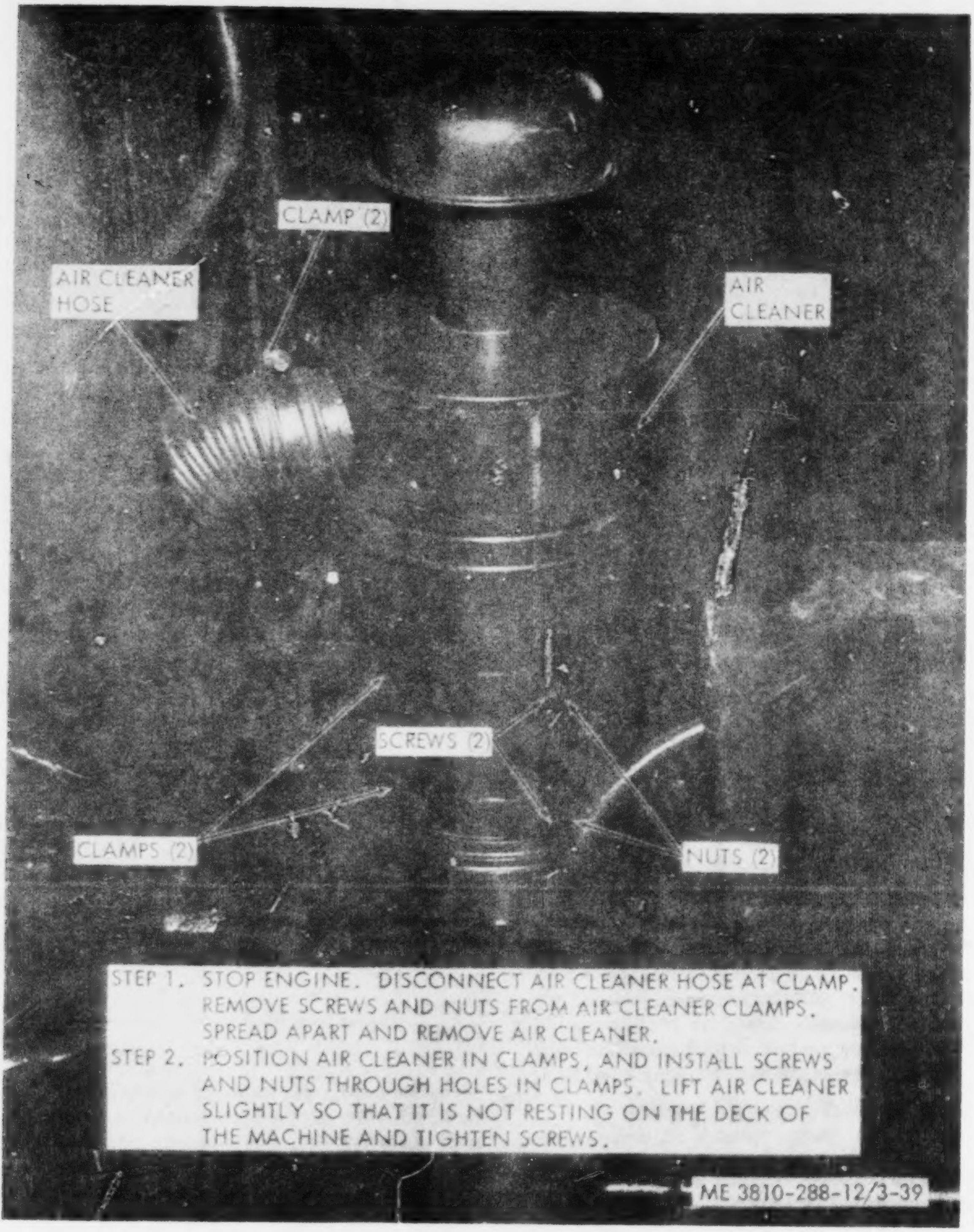
STEP 2. INSERT CABLE THROUGH OPENING IN CONTROL PANEL, AND INSTALL JAM NUT. INSTALL NEW CHOKE CABLE IN SAME POSITION AS OLD CABLE. ATTACH CABLE TO CARBURETOR AS SHOWN IN FIGURE 3-32.

STEP 3. STOP ENGINE. DISCONNECT FUEL LINES, REMOVE TOP OF PUMP, AND TOP JAM NUT. REMOVE BOTTOM OF PUMP FROM CONTROL PANEL.

STEP 4. INSTALL JAM NUT ON BOTTOM OF PUMP, INSERT PUMP THROUGH OPENING IN CONTROL PANEL, AND INSTALL TOP JAM NUT. INSTALL TOP OF PUMP IN BOTTOM OF PUMP. CONNECT FUEL LINES.

ME 3810-288-12/3-38

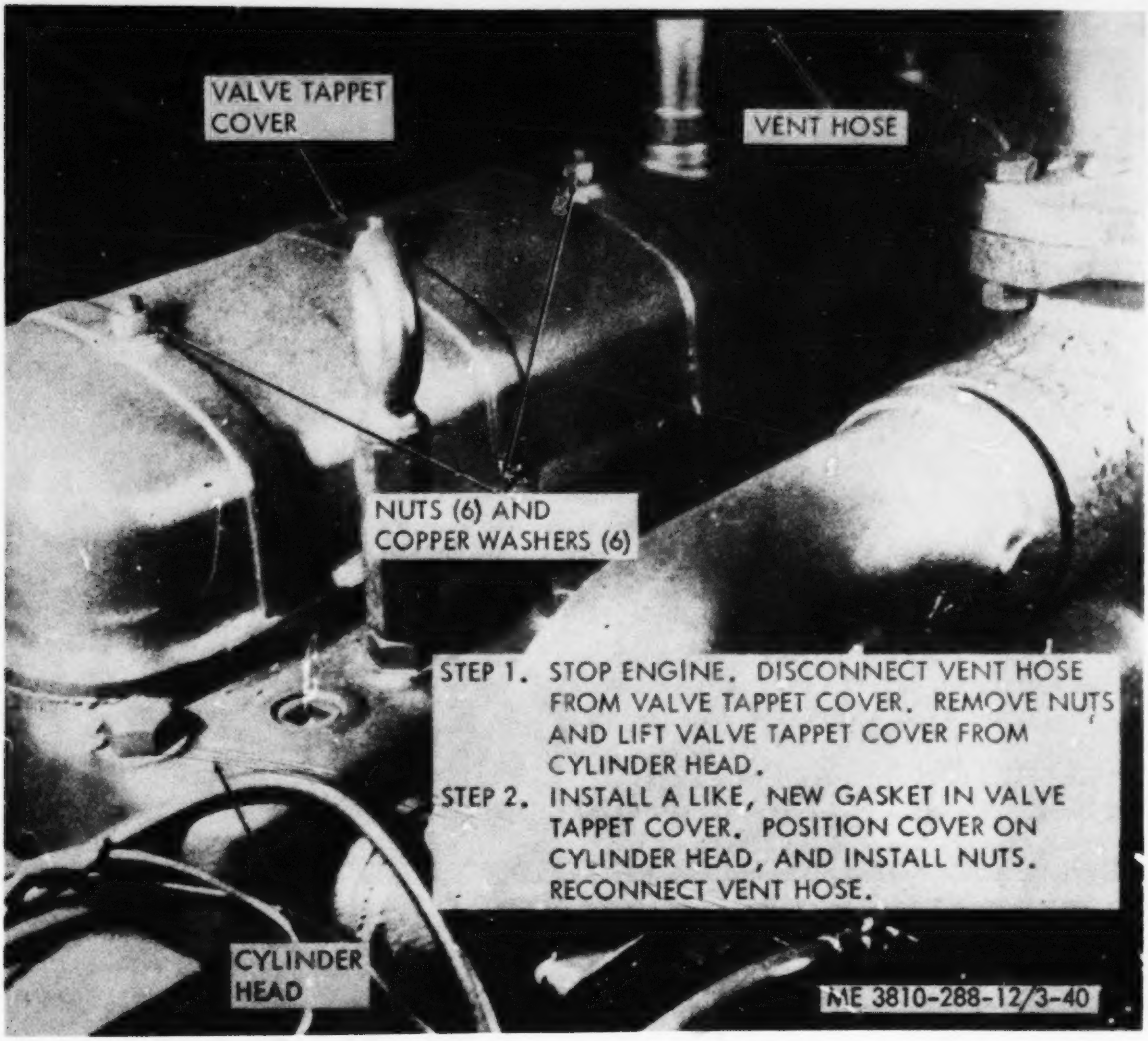
Figure 3-38. Engine choke control, component replacement, and engine starting aid pump, removal and replacement.


CLAMP (2)
AIR CLEANER HOSE
AIR CLEANER
SCREWS (2)
CLAMPS (2)
NUTS (2)
ME 3810-288-12/3-39

STEP 1. STOP ENGINE. DISCONNECT AIR CLEANER HOSE AT CLAMP. REMOVE SCREWS AND NUTS FROM AIR CLEANER CLAMPS. SPREAD APART AND REMOVE AIR CLEANER.

STEP 2. POSITION AIR CLEANER IN CLAMPS, AND INSTALL SCREWS AND NUTS THROUGH HOLES IN CLAMPS. LIFT AIR CLEANER SLIGHTLY SO THAT IT IS NOT RESTING ON THE DECK OF THE MACHINE AND TIGHTEN SCREWS.

Figure 3-39. Engine air cleaner, removal and replacement.


VALVE TAPPET COVER
VENT HOSE
NUTS (6) AND COPPER WASHERS (6)
CYLINDER HEAD
ME 3810-288-12/3-40

STEP 1. STOP ENGINE. DISCONNECT VENT HOSE FROM VALVE TAPPET COVER. REMOVE NUTS AND LIFT VALVE TAPPET COVER FROM CYLINDER HEAD.

STEP 2. INSTALL A LIKE, NEW GASKET IN VALVE TAPPET COVER. POSITION COVER ON CYLINDER HEAD, AND INSTALL NUTS. RECONNECT VENT HOSE.

Figure 3-40. Valve tappet cover, removal and replacement.

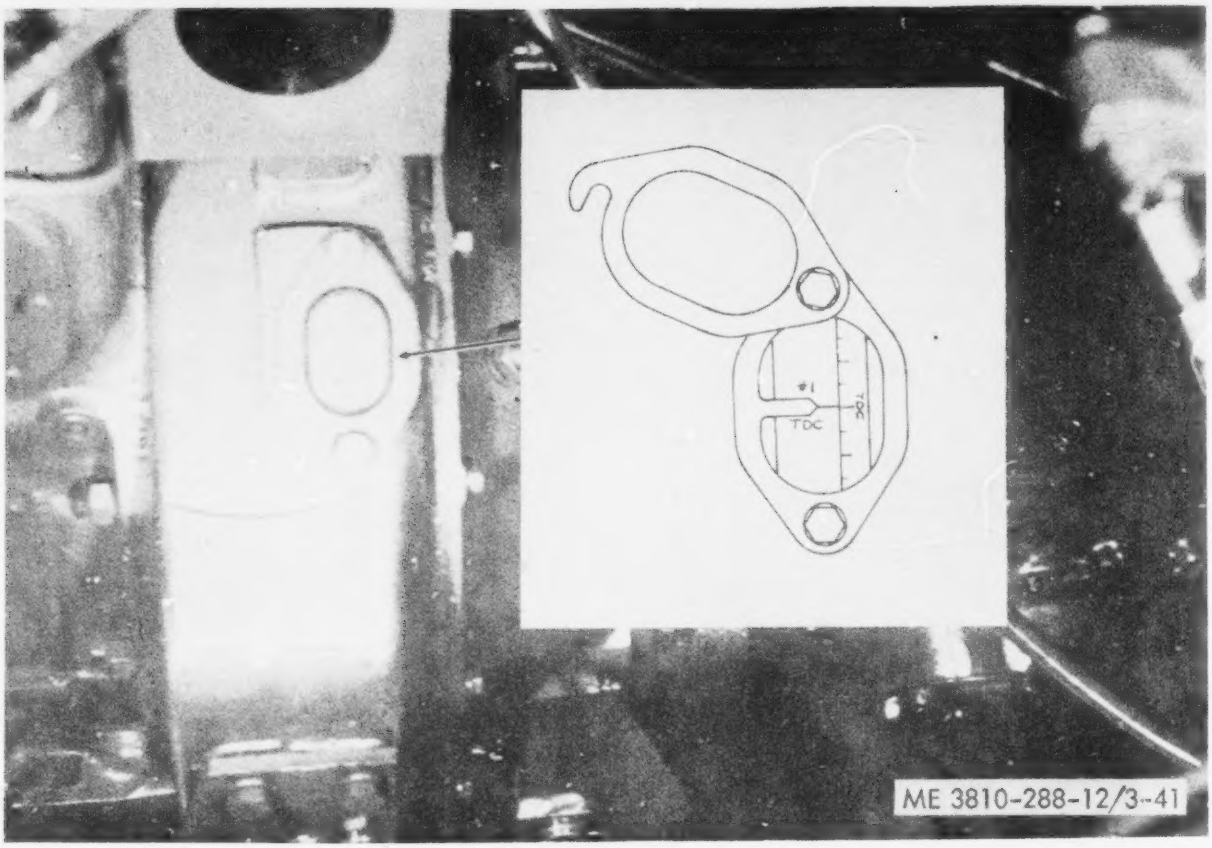

#1
TDC
TDC
ME 3810-288-12/3-41

Figure 3-41. Flywheel timing marks, number one piston on top dead center compression stroke

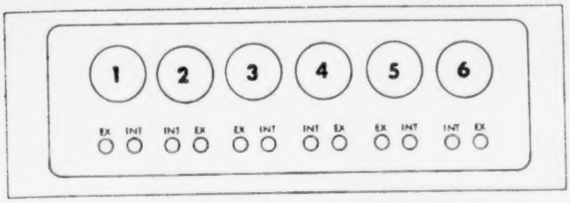


Figure 3-42. Arrangement of exhaust and intake valves.

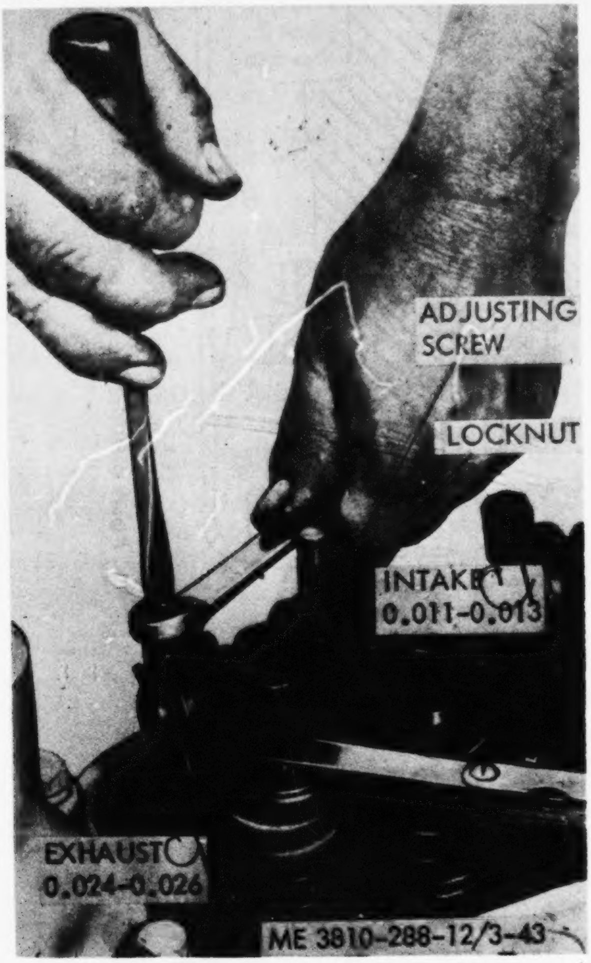


Figure 3-43. Adjusting valve tappet clearance.

motor, since their purpose is to provide reduced starting power by cutting in one at a time. The magnetic switches are electrically located in figure 1-14. One magnetic switch is located beneath the starting motor and the other on a bracket above the flywheel housing, as shown in figure 1-8. Removal and replacement procedures are the same for both switches. Refer to figure 3-52, part three and remove electrical leads and the two mounting screws and lockwashers. Then remove the magnetic switch.

d. Distributor (Ignitor). The distributor on this machine is called an ignitor, since both the distributor and the ignition coil are combined into one unit. Replace a defective distributor as follows:

(1) *Removal.*

(*a*) Refer to paragraph 3-49*f* and remove suppression leads from spark plugs. Disconnect the primary lead from the distributor and the ground strap from the engine. Refer to figure 3-53.

(*b*) Refer to figure 3-53 and remove hold down screws and clamps. Lift distributor from the tachometer drive.

(2) *Replacement.*

(*a*) *Breaker point adjustment.* The breaker points must be accurately adjusted for clearance. Refer to figure 3-54. Breaker point clearance may be adjusted before the distributor is installed on the engine. Remove cover screws and remove the metal cover from distributor (fig. 3-53). Turn shaft so that breaker arm rubbing point is on the high point of the cam (fig. 3-54) Loosen the clamp screw (fig. 3-54) slightly. Adjust breaker point clearance by turning the eccentric screw. Check clearance with a 0.022 inch round feeler gage. Tighten fixed breaker point clamp screw. Turn shaft so that breaker points are closed. Inspect breaker point alinement. Bend fixed point bracket so that points are alined for full face contact. Check and readjust breaker point clearance if necessary.

(*b*) *Distributor installation.* Turn the engine to firing TDC (top dead center) position on the compression stroke for number one cylinder as shown in figure 3-41. Install the rotor and turn it so that it is pointing to the number one suppression lead contact in the distributor cap. Insert the drive shaft in the tachometer drive opening with the distributor body held approximately the same as it was when removed. Do not allow the shaft to turn. Install clamps and hold down screw (fig. 3-53) and tighten the screws finger tight. Connect the primary lead to the distributor and the ground strap to the engine.

(*c*) *Distributor timing.* The timing of the spark depends on the breaking of electrical con-

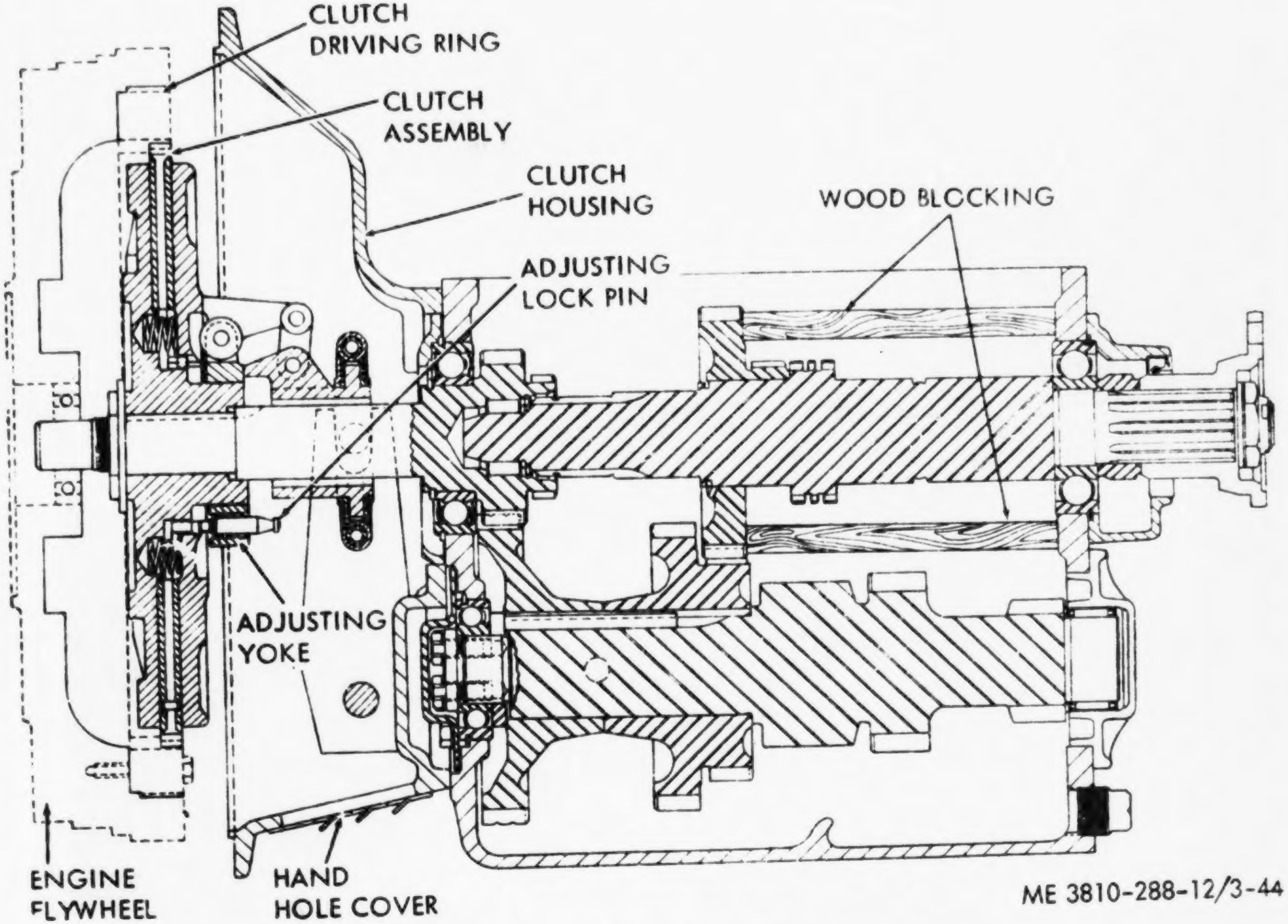

CLUTCH DRIVING RING
CLUTCH ASSEMBLY
CLUTCH HOUSING
WOOD BLOCKING
ADJUSTING LOCK PIN
ADJUSTING YOKE
ENGINE FLYWHEEL
HAND HOLE COVER
ME 3810-288-12/3-44

Figure 3-44. Engine clutch adjustment.

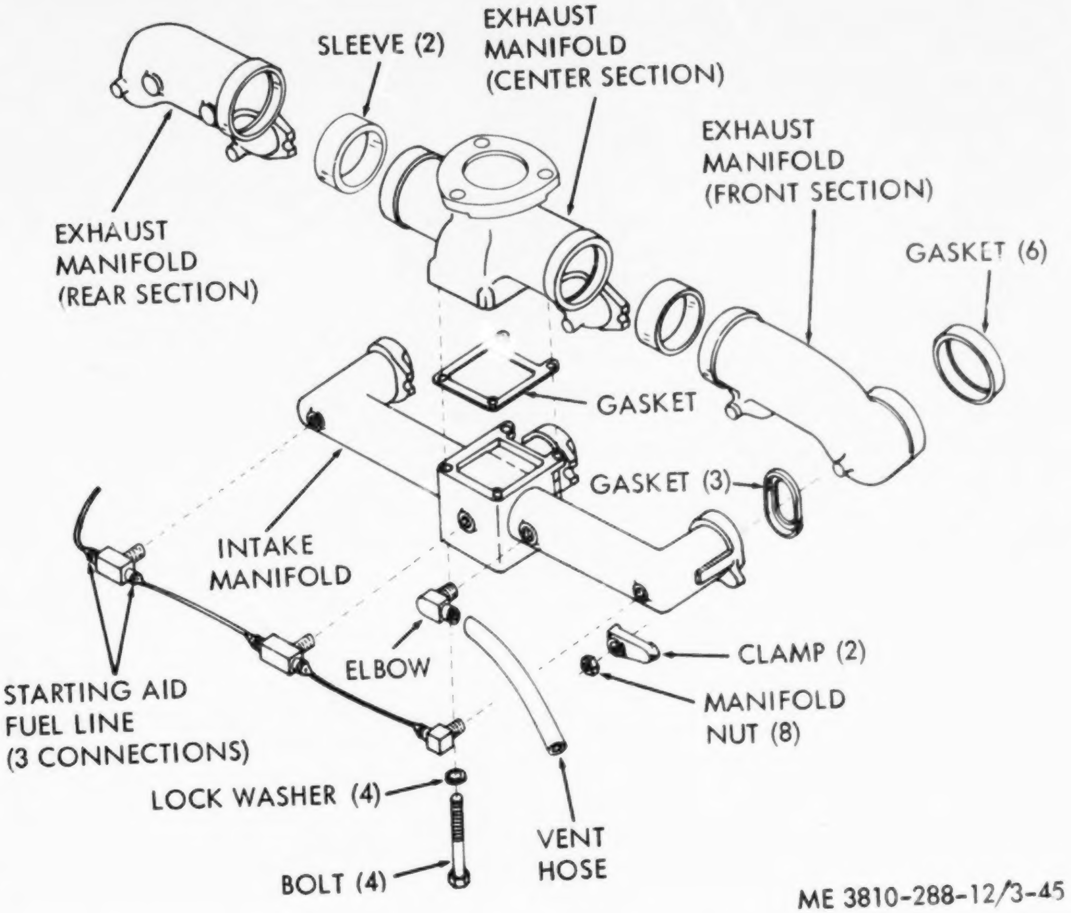
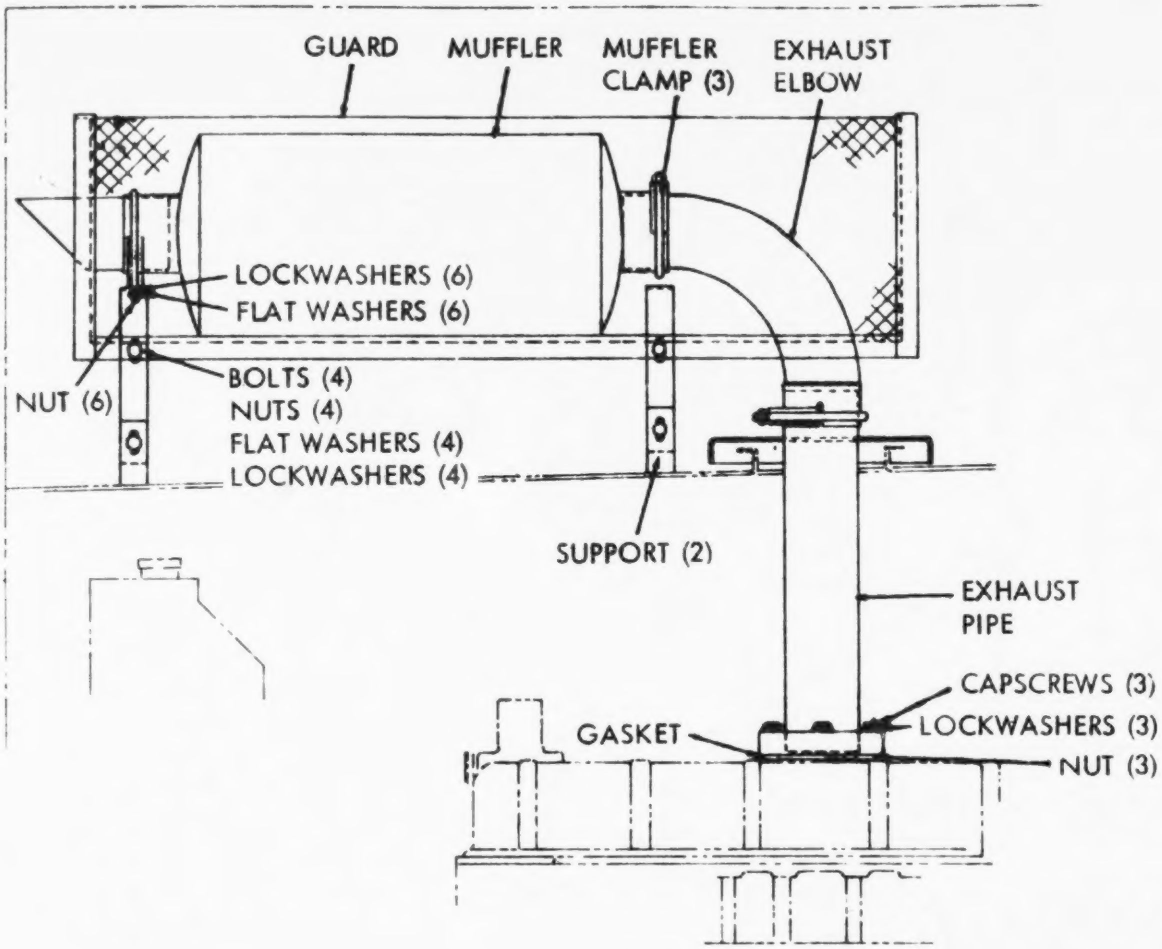

EXHAUST MANIFOLD (REAR SECTION)
SLEEVE (2)
EXHAUST MANIFOLD (CENTER SECTION)
EXHAUST MANIFOLD (FRONT SECTION)
GASKET (6)
GASKET
GASKET (3)
INTAKE MANIFOLD
STARTING AID FUEL LINE (3 CONNECTIONS)
ELBOW
CLAMP (2)
MANIFOLD NUT (8)
LOCK WASHER (4)
BOLT (4)
VENT HOSE
ME 3810-288-12/3-45

Figure 3-45. Intake and exhaust manifolds, removal and replacement.


GUARD
MUFFLER
MUFFLER CLAMP (3)
EXHAUST ELBOW
LOCKWASHERS (6)
FLAT WASHERS (6)
NUT (6)
BOLTS (4)
NUTS (4)
FLAT WASHERS (4)
LOCKWASHERS (4)
SUPPORT (2)
EXHAUST PIPE
CAPSCREWS (3)
LOCKWASHERS (3)
GASKET
NUT (3)

ME 3810-288-12/3-46

Figure 3-46. Exhaust muffler and piping, removal and replacement.

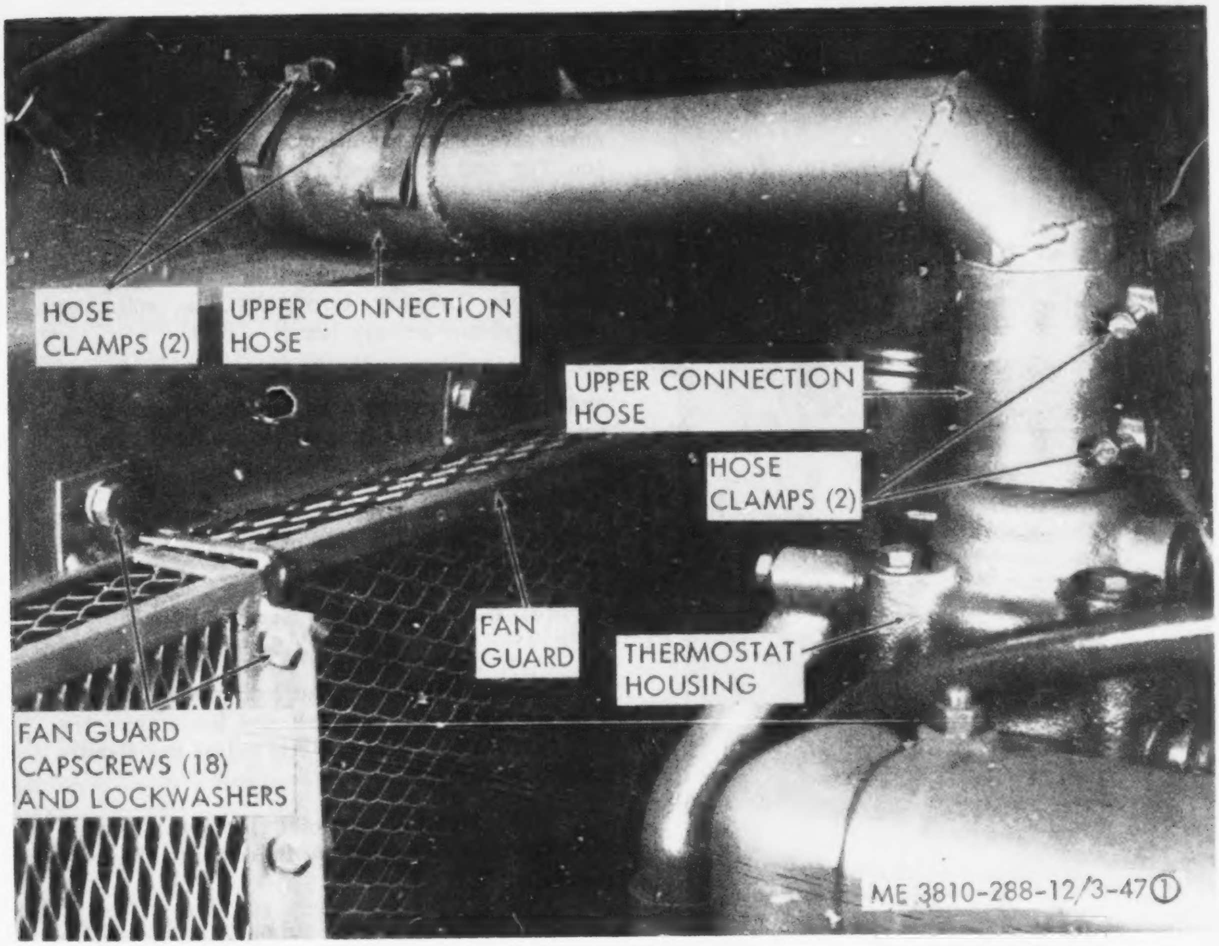

HOSE CLAMPS (2)
UPPER CONNECTION HOSE
UPPER CONNECTION HOSE
HOSE CLAMPS (2)
FAN GUARD
THERMOSTAT HOUSING
FAN GUARD CAPSCREWS (18) AND LOCKWASHERS
ME 3810-288-12/3-47①

Figure 3-47. Radiator, guard, and hoses, removal and replacement. (Sheet 1 of 3)

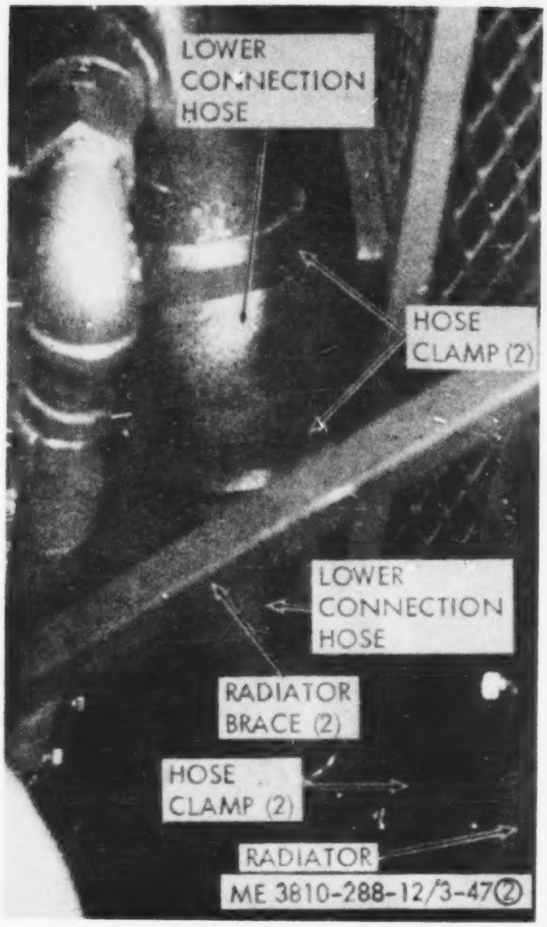


Figure 3-47. Radiator guard and hoses, removal and replacement. (Sheet 2 of 3)

tact at the breaker points. To assure accurate timing, make up a simple light circuit consisting of a 24 volt automotive light bulb with soldered-on leads or a socket with leads attached as shown in figure 3-54. Clip one lead to the lead to the movable breaker point, and attach the other lead to ground. Turn the engine to TDC on the compression stroke for number one cylinder as shown in figure 3-41. Turn the ignition switch to the ON position. Rotate the distributor body (fig. 3-53) slightly to determine the point of breaker point opening, which will be the point where the light turns on. Tighten the hold down screws at the base of the distributor, making sure the body does not turn further.

(*d*) Cover installation. Install the metal cover on the distributor and connect the suppression leads to spark plugs as described in paragraph 3-49*f*.

(3) *Testing distributor coil.*

(*a*) Refer to figure 3-53 and remove the cover screws and metal cover from the distributor. Tag and disconnect the primary leads from the coil.

(*b*) Check the continuity of the coil primary (fig. 3-54) by connecting a DC voltmeter across the primary terminals. The voltmeter reading should be very low.

(c) Check the continuity of the coil secondary by connecting a DC voltmeter across one primary terminal and the secondary terminal. The voltmeter reading should be high.

(*d*) If no reading or an infinite reading is obtained, the coil is open or shorted, and should be replaced. Refer to (4) below.

(4) *Distributor coil replacement.*

(*a*) Refer to figure 3-53 and remove the cover screws and metal cover from the distributor. Tag and disconnect the primary leads from the coil (fig. 3-54). Press the coil out of the distributor body carefully.

(*b*) Position new coil in the opening in the distributor body and press the coil into the body carefully.

(*c*) Reconnect the primary leads and install the metal cover with cover screws on the distributor body.

(*d*) If possible, it is recommended that the distributor and coil be re-waterproofed by spraying with a clear acrylic varnish.

(5) *Point and capacitor replacement.*

(*a*) Remove metal cover (fig. 3-53). Refer to figure 3-54 and lift off rotor.

(*b*) Remove eccentric screw (fig. 3-54). Remove clamp screw.

(*c*) Remove both the fixed point and bracket, and the moveable breaker point, as an assembly. Remove the capacitor by removing the mounting screw and lockwasher.

(*d*) Install capacitor, points and rotor, in the reverse order of removal. Adjust the point

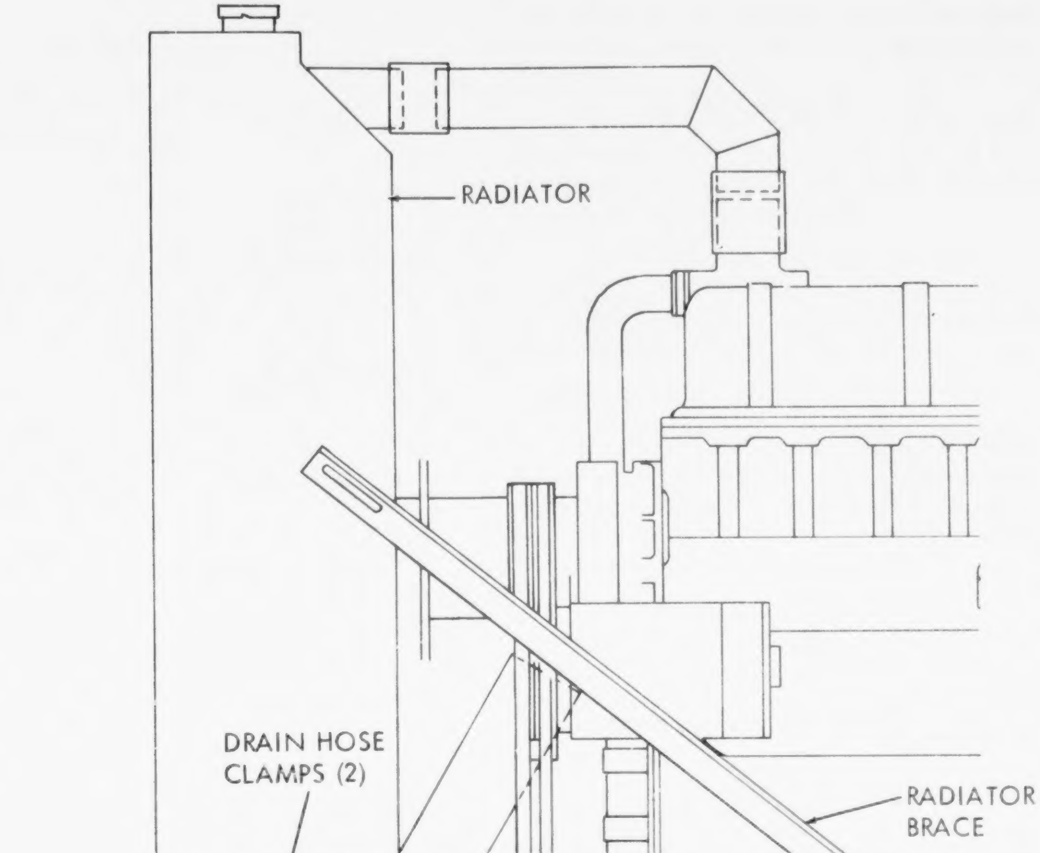

RADIATOR
DRAIN HOSE CLAMPS (2)
RADIATOR BRACE
NUT (2)
WASHER (6)
MOUNTING STUD (2)
RADIATOR MOUNTING BRACKET
ME 3810-288-12/3-47③

Figure 3-47. Radiator guard and hoses, removal and replacement. (Sheet 3 of 3)

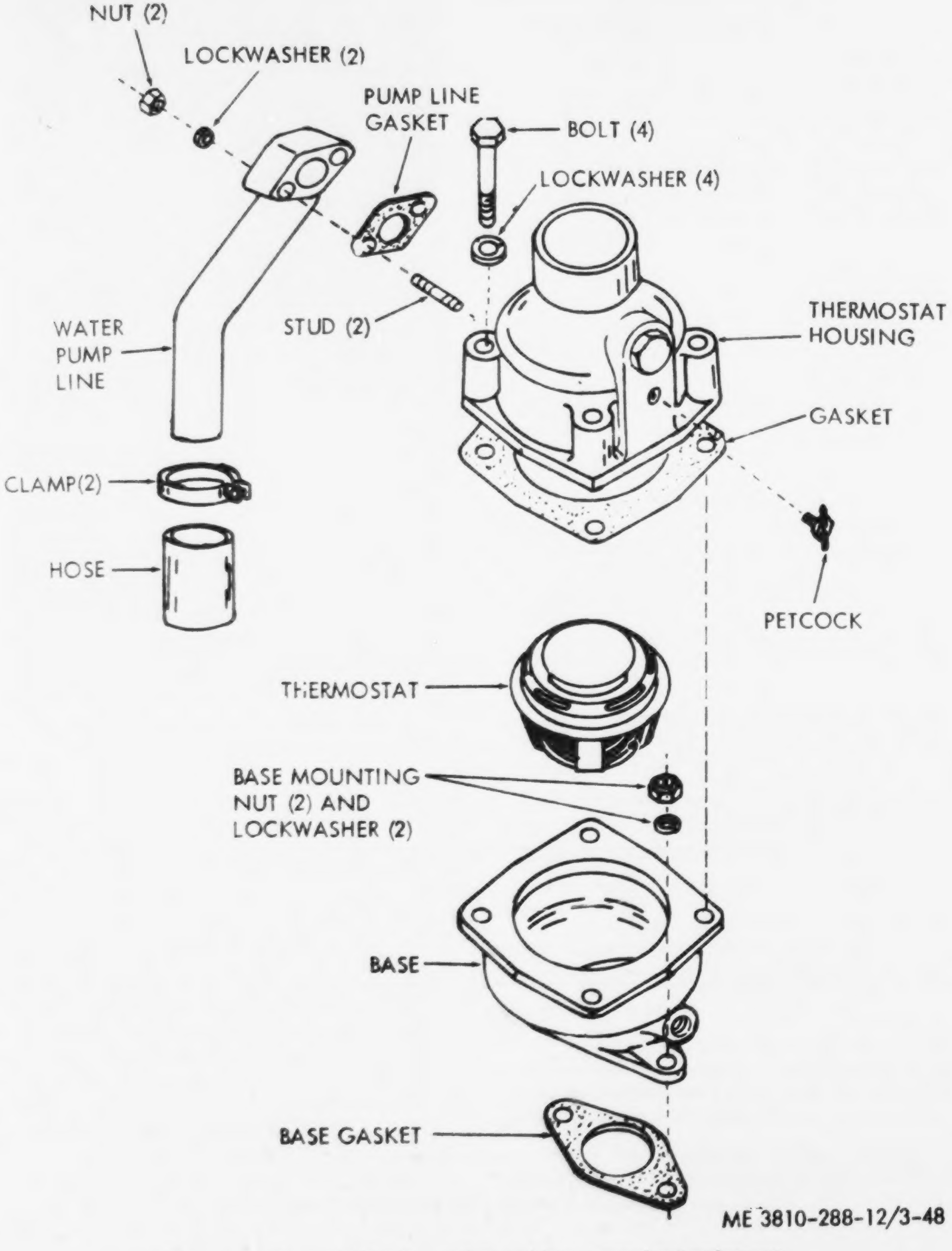
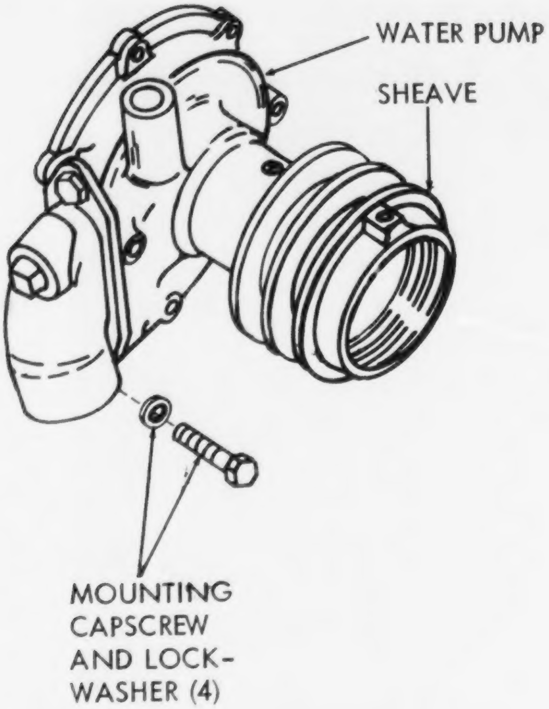

NUT (2)
LOCKWASHER (2)
PUMP LINE GASKET
BOLT (4)
LOCKWASHER (4)
WATER PUMP LINE
STUD (2)
THERMOSTAT HOUSING
GASKET
CLAMP(2)
HOSE
PETCOCK
THERMOSTAT
BASE MOUNTING NUT (2) AND LOCKWASHER (2)
BASE
BASE GASKET
ME 3810-288-12/3-48

Figure 3-48. Thermostat, housing, gaskets, and lines, removal and replacement.



STEP 1. REMOVE MOUNTING CAPSCREWS AND LOCKWASHERS.
STEP 2. REMOVE WATER PUMP AND SHEAVE AS AN ASSEMBLY.
STEP 3. REINSTALL A LIKE, SERVICEABLE WATER PUMP.

ME 3810-288-12/3-49

Figure 3-49. Water pump, removal and replacement.

gap as described in this paragraph. Reinstall the cover (fig. 3-53).

Note. Always replace spark plugs, points, and condenser at the same time spark plugs are replaced.

e. Spark Plugs.

(1) *Removal.* Unscrew the shielded ignition leads at the top of the spark plugs and place a deep socket spark plug wrench on the spark plug hexagon. Unscrew spark plugs and remove. Be careful not to lose the metal gasket beneath the spark plug.

(2) *Test.* Inspect spark plugs for obvious cracks, broken or severely worn points, pitting, discoloration, or accumulations of foreign material. Discard any spark plug not in good apparent condition. If available, install the plugs in a spark plug tester and check for adequate performance.

(3) *Adjustment.* Gap the spark plugs to a clearance of from 0.023 to 0.028 inch. Use a round feeler gauge in preference to a flat gauge, since a flat gauge will give incorrect readings.

(4) *Installation.* Install spark plugs finger tight. Then tighten them to 20 foot pounds, using a torque wrench, if available. If not available, snug the plugs down firmly. Do not overtighten.

f. Suppression Leads.

(1) *Removal.* Refer to figure 3-53 for a view of the suppression leads. These leads are from the distributor (ignitor) to the spark plugs. The leads are removed by unscrewing them at the distributor and the individual spark plugs.

(2) *Test.* Connect suppression lead to positive side of any battery. Place the tip of a light bulb on the negative terminal. Hold the other end of this lead against the metal side of the light bulb. If the light bulb illuminates, the lead is at least not an open circuit, and may be fit for further use. If the light does not come on, replace the lead. If an ohmmeter is available, the lead should test above 2,000 ohms per inch of length.

g. Slave Cable Receptacle. Refer to figure 3-55 and replace a faulty slave receptacle.

h. Lights.

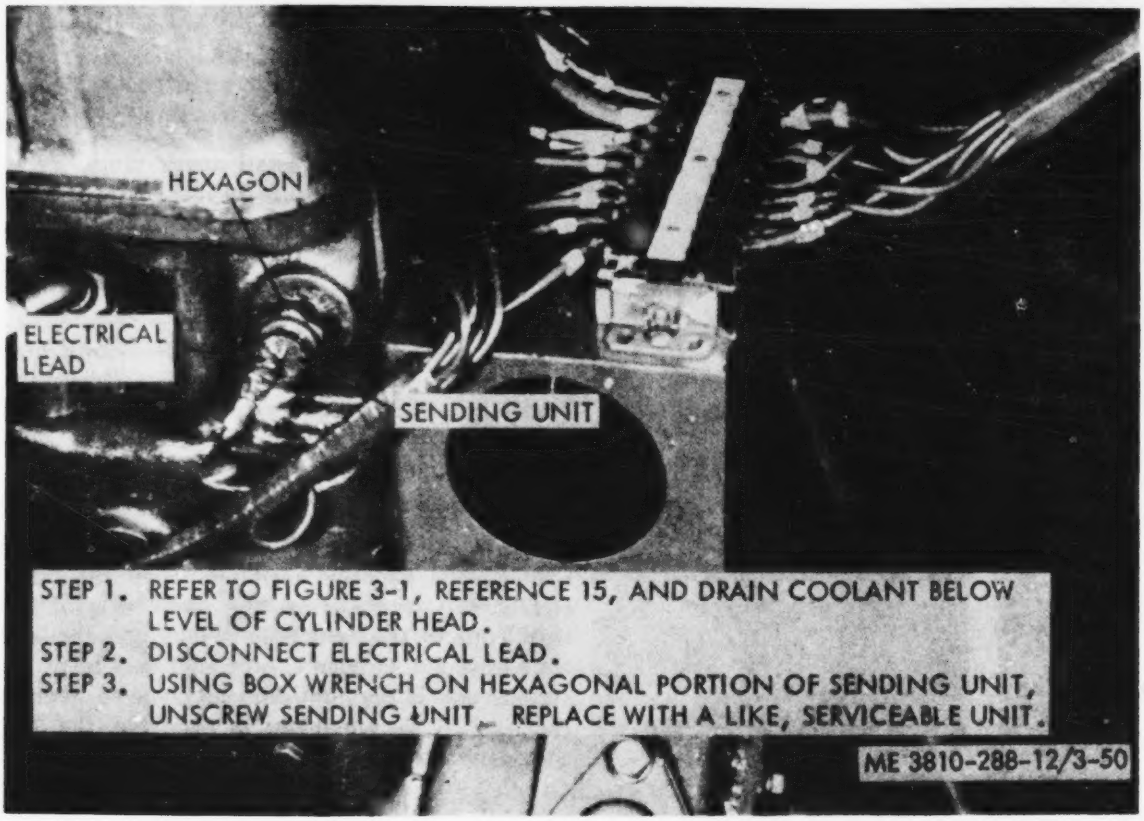
(1) *Headlights.* Refer to figure 3-56 and replace faulty headlights.

(2) *Marker lights, dome lights, flood lights, and trouble lights.* Each of the various types of lights furnished with this machine, both upper and carrier portions, are illustrated in figure 3-57. Refer to figure 3-57 and remove or replace any defective light component.

i. Reverse Polarity Relay.

(1) *General.* The reverse polarity relay contains a solid state rectifier which prevents current from flowing through the engine starting circuit in the wrong direction. Refer to the wiring diagram of the relay in figure 3-58.

(2) *Testing.* With the relay removed from the engine, connect a 24 volt source to connector C (fig. 3-58). Then touch the relay case to ground.

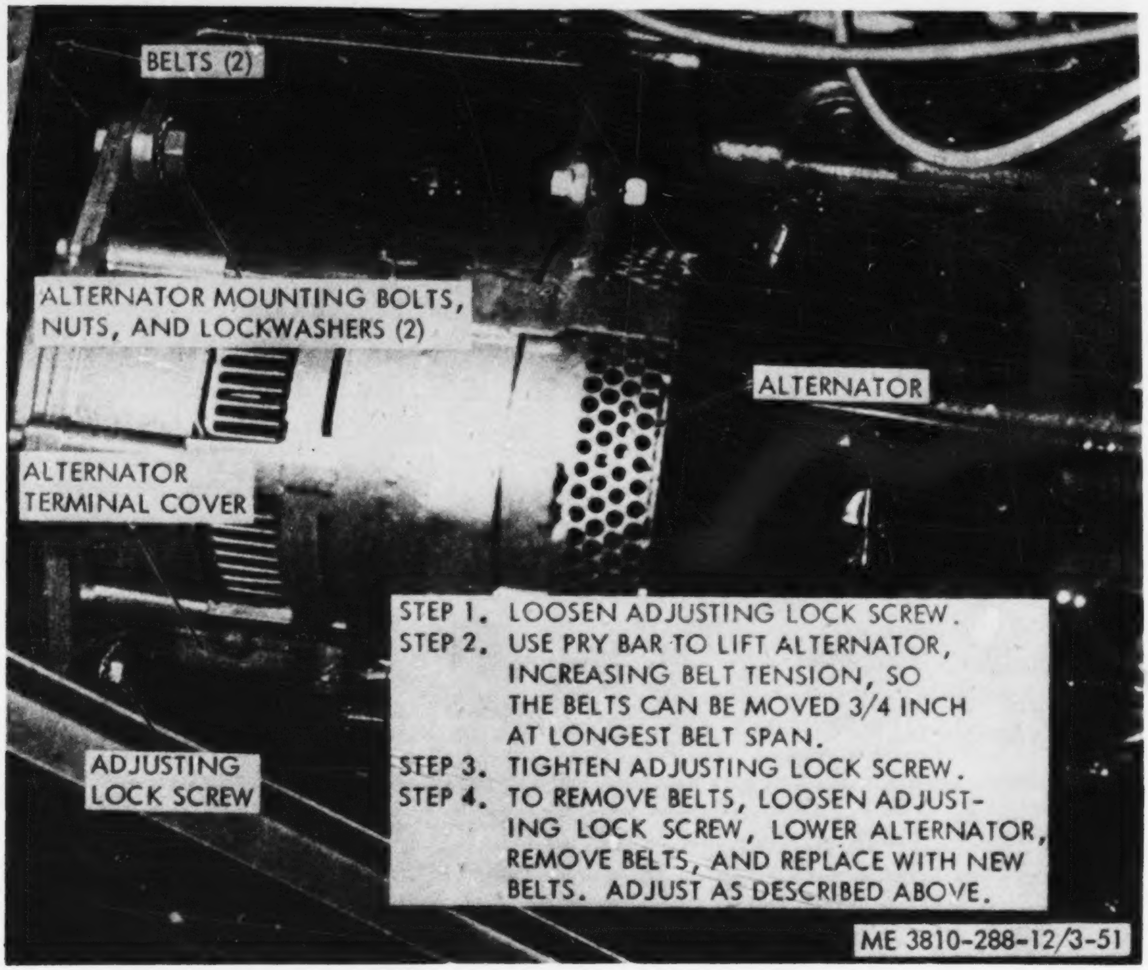

HEXAGON
ELECTRICAL LEAD
SENDING UNIT
ME 3810-288-12/3-50

STEP 1. REFER TO FIGURE 3-1, REFERENCE 15, AND DRAIN COOLANT BELOW LEVEL OF CYLINDER HEAD.

STEP 2. DISCONNECT ELECTRICAL LEAD.

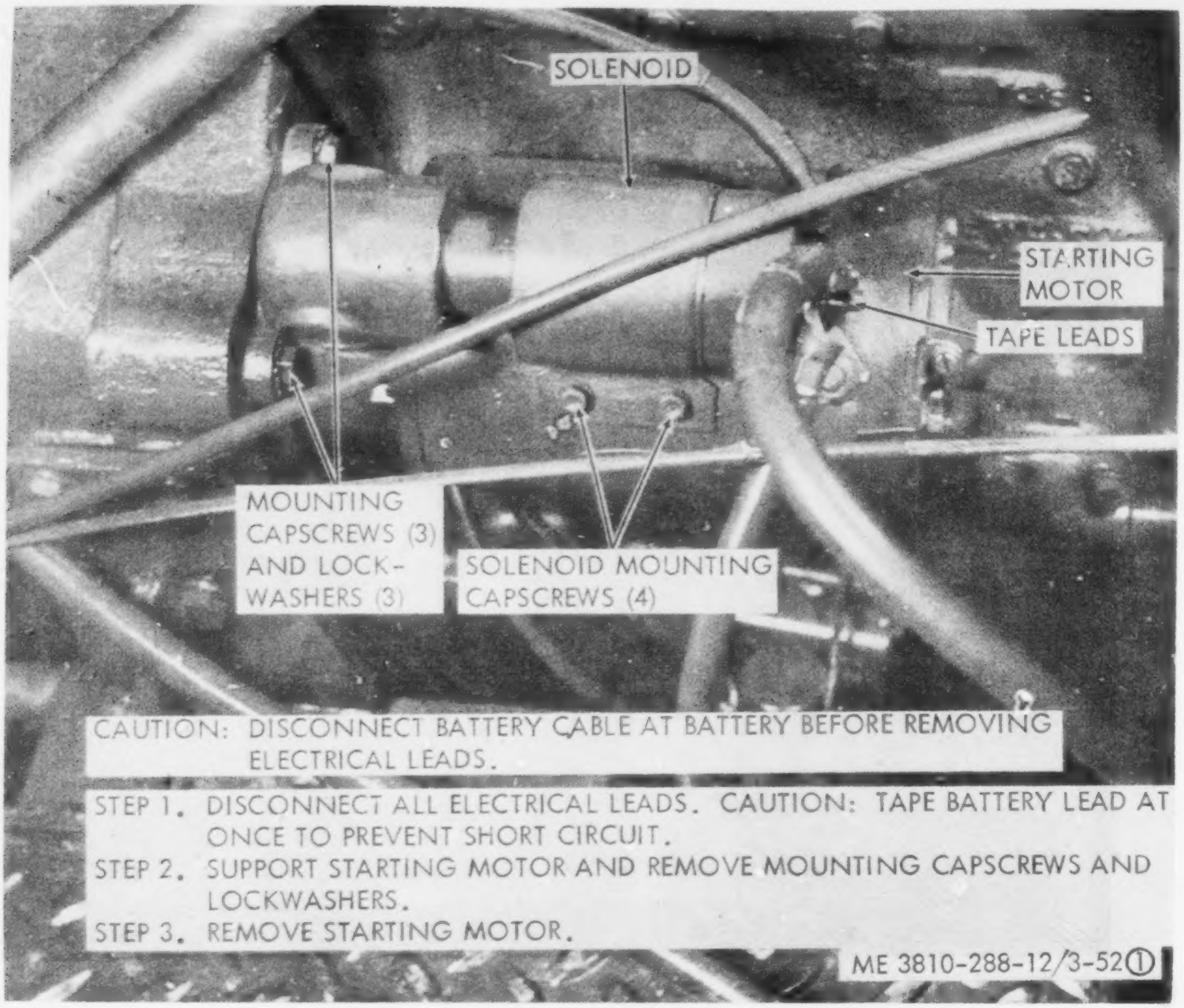
STEP 3. USING BOX WRENCH ON HEXAGONAL PORTION OF SENDING UNIT, UNSCREW SENDING UNIT. REPLACE WITH A LIKE, SERVICEABLE UNIT.

Figure 3–50. Water temperature sender, removal and replacement.


BELTS (2)
ALTERNATOR MOUNTING BOLTS, NUTS, AND LOCKWASHERS (2)
ALTERNATOR
ALTERNATOR TERMINAL COVER
ADJUSTING LOCK SCREW
ME 3810-288-12/3-51

STEP 1. LOOSEN ADJUSTING LOCK SCREW.
STEP 2. USE PRY BAR TO LIFT ALTERNATOR, INCREASING BELT TENSION, SO THE BELTS CAN BE MOVED 3/4 INCH AT LONGEST BELT SPAN.
STEP 3. TIGHTEN ADJUSTING LOCK SCREW.
STEP 4. TO REMOVE BELTS, LOOSEN ADJUSTING LOCK SCREW, LOWER ALTERNATOR, REMOVE BELTS, AND REPLACE WITH NEW BELTS. ADJUST AS DESCRIBED ABOVE.

Figure 3-51. Alternator belt tension adjustment, removal and replacement.


SOLENOID
STARTING MOTOR
TAPE LEADS
MOUNTING CAPSCREWS (3) AND LOCKWASHERS (3)
SOLENOID MOUNTING CAPSCREWS (4)

CAUTION: DISCONNECT BATTERY CABLE AT BATTERY BEFORE REMOVING ELECTRICAL LEADS.

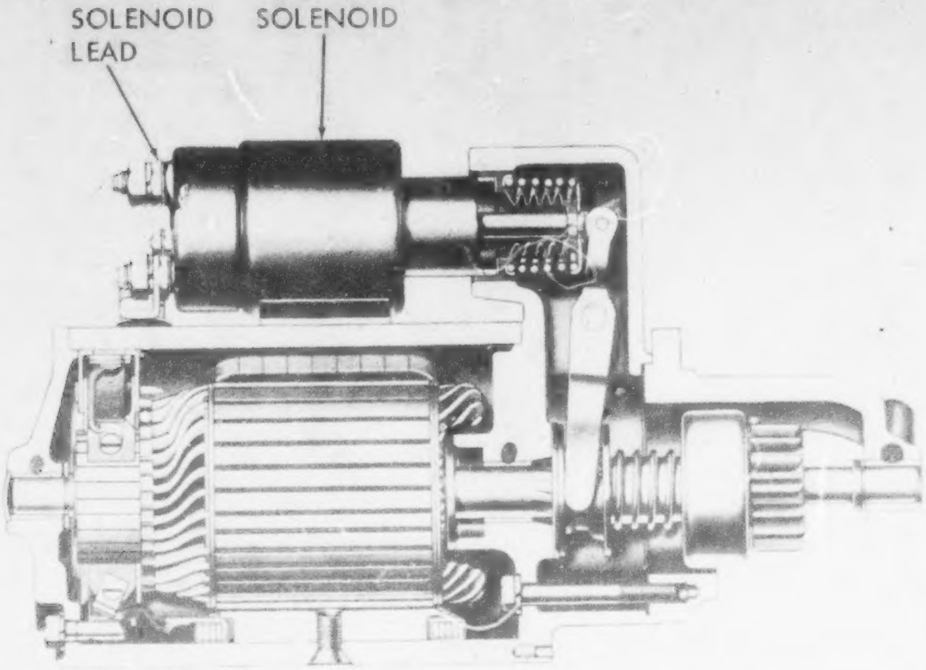
STEP 1. DISCONNECT ALL ELECTRICAL LEADS. CAUTION: TAPE BATTERY LEAD AT ONCE TO PREVENT SHORT CIRCUIT.

STEP 2. SUPPORT STARTING MOTOR AND REMOVE MOUNTING CAPSCREWS AND LOCKWASHERS.

STEP 3. REMOVE STARTING MOTOR.

ME 3810-288-12/3-52①

Figure 3-52. Starting motor and solenoids, removal and replacement. (Sheet 1 of 3)


SOLENOID LEAD
SOLENOID

STEP 1. REMOVE AND TAPE SOLENOID LEADS.
STEP 2. REMOVE SOLENOID MOUNTING CAPSCREWS.
STEP 3. REMOVE SOLENOID.

ME 3810-288-12/3-52②

Figure 3-52. Starting motor and solenoids, removal and replacement (Sheet 2 of 3)

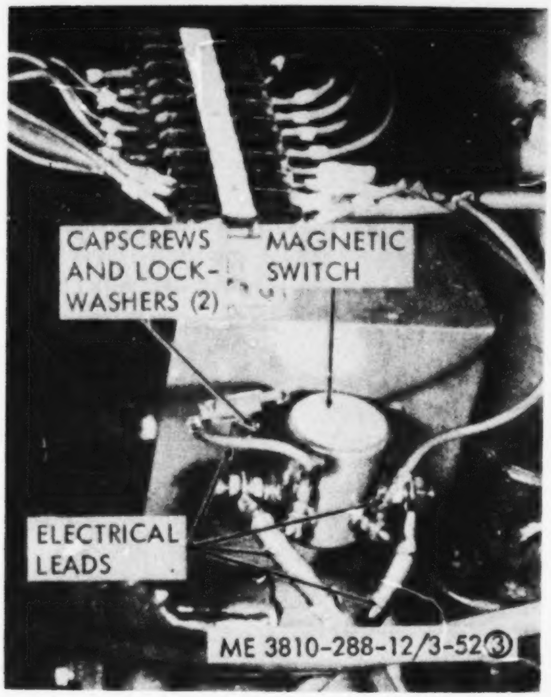


Figure 3-52. Starting motor and solenoids, removal and replacement. (Sheet 3 of 3)

The polarities shown on the diagram must be observed. When this is done, the relay will be energized, and an audible "click" can be heard when the relay contacts close. If the contacts close, the relay is to be considered in good condition.

(3) *Replacement.* Disconnect the three cannon plug type electrical connections to the reverse polarity relay, and remove the two mounting capscrews and lockwashers (fig. 3-58).

j. Batteries.

(1) *Test.* Test the batteries with a hydrometer. If the specific gravity reads below 1.225, recharge the batteries. Test the batteries with the hydrometer after recharging. A fully charged battery should read between 1.280 and 1.300. Replace a battery that will not take or hold a charge. The specific gravity difference between cells must be within 0.025. Remove battery filler caps and add water to ⅜ inch above plates before recharging. Refer to tables 3-4 and 3-5.

(2) Refer to figure 3-59 and remove and replace faulty battery, cable, or battery box.

k. Wiring Harness.

(1) Wiring must be regularly inspected for frayed insulation, broken wires, corroded terminals, loose terminals and ground connections and broken or missing cable clamps. Check electrical connections on the instrument panel for tightness.

(2) Repair a damaged or broken wire by cutting a length of wire and taping it along the harness. Install two clips at either end and remove the broken wire. Secure the end of the new wire to the end of the old wire and insulate with electrical tape.

Table 3-4. Battery Condition (Corrected to 80° F.)

Specific gravity	Battery condition
1.280	Fully charged.
1.250	75% charged.
1.220	50% charged.
1.190	25% charged.
1.160	Almost discharged.
1.130	Discharged.

Table 3-5. Electrolyte Freezing Points

Specific gravity	Temperature °F.
1.280	−90
1.250	−62
1.200	−16
1.150	+5
1.100	+19

l. Horn Switch and Wiring. **Refer to figure 3-60 and replace a defective horn switch. Refer to paragraph 3-49*k* and replace defective wiring.**

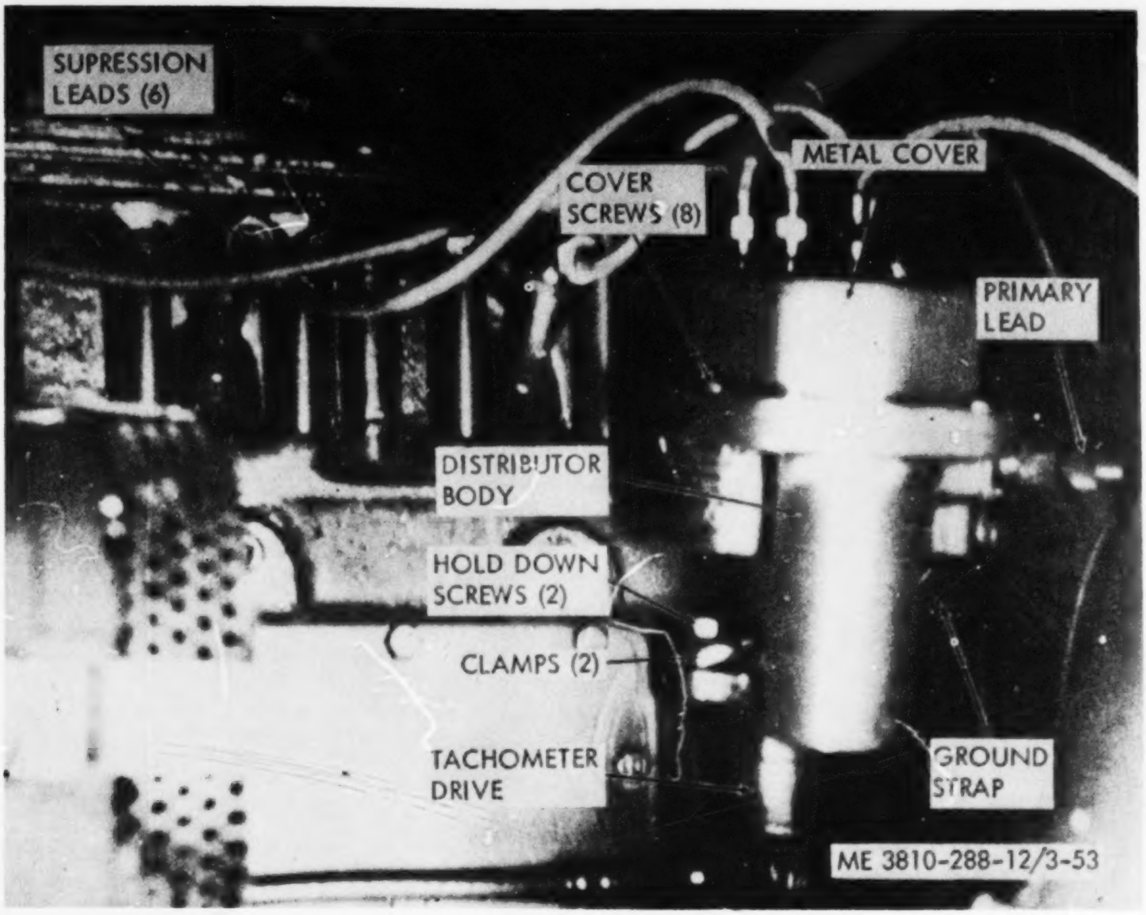
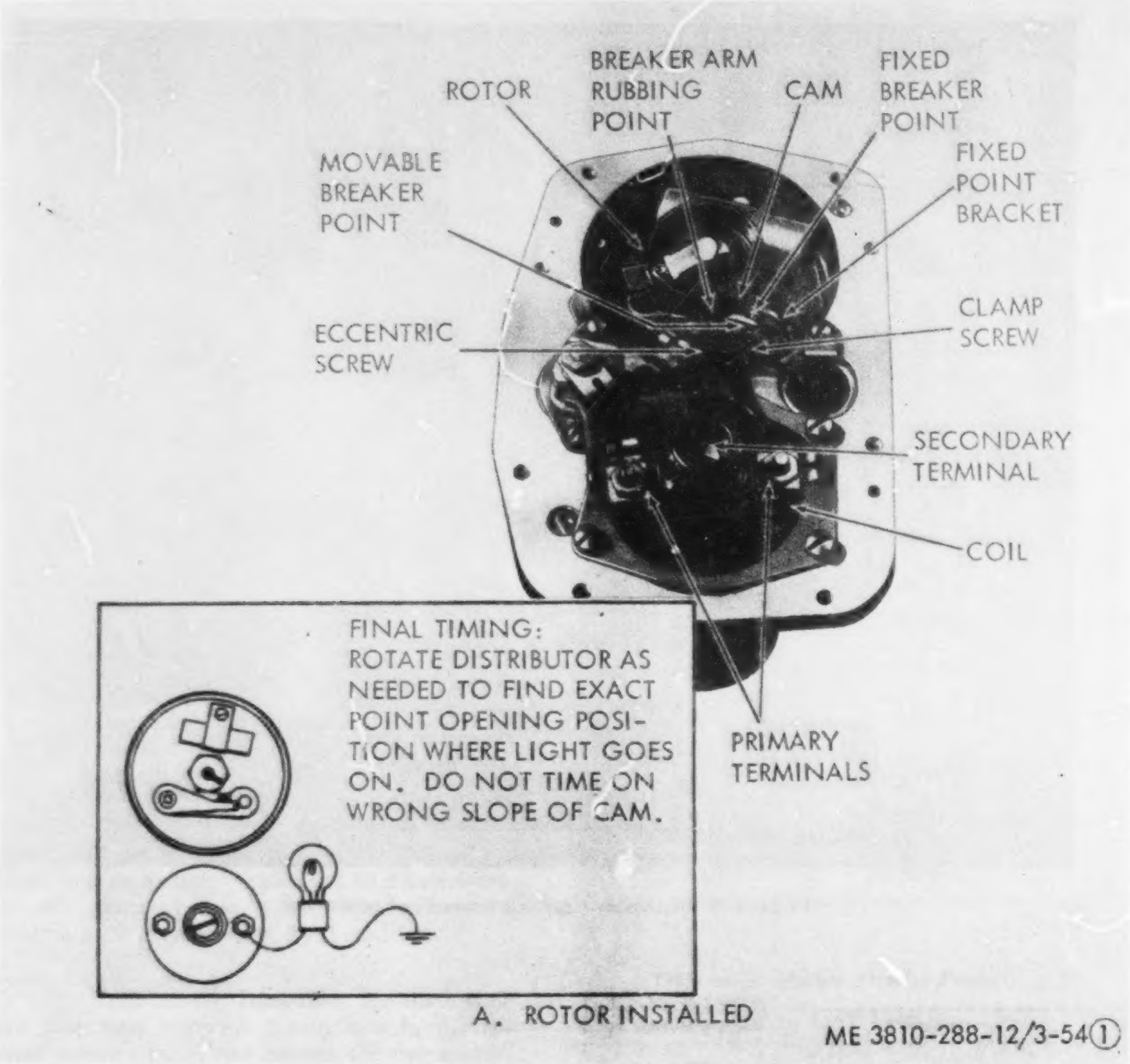

SUPRESSION LEADS (6)
COVER SCREWS (8)
METAL COVER
PRIMARY LEAD
DISTRIBUTOR BODY
HOLD DOWN SCREWS (2)
CLAMPS (2)
TACHOMETER DRIVE
GROUND STRAP
ME 3810-288-12/3-53

Figure 3-53. Distributor (ignitor), removal and replacement.


ROTOR
BREAKER ARM RUBBING POINT
CAM
FIXED BREAKER POINT
FIXED POINT BRACKET
MOVABLE BREAKER POINT
ECCENTRIC SCREW
CLAMP SCREW
SECONDARY TERMINAL
COIL
PRIMARY TERMINALS
FINAL TIMING:
ROTATE DISTRIBUTOR AS NEEDED TO FIND EXACT POINT OPENING POSITION WHERE LIGHT GOES ON. DO NOT TIME ON WRONG SLOPE OF CAM.
ME 3810-288-12/3-54①

A. ROTOR INSTALLED

Figure 3-54. Distributor adjustment. (Sheet 1 of 2)

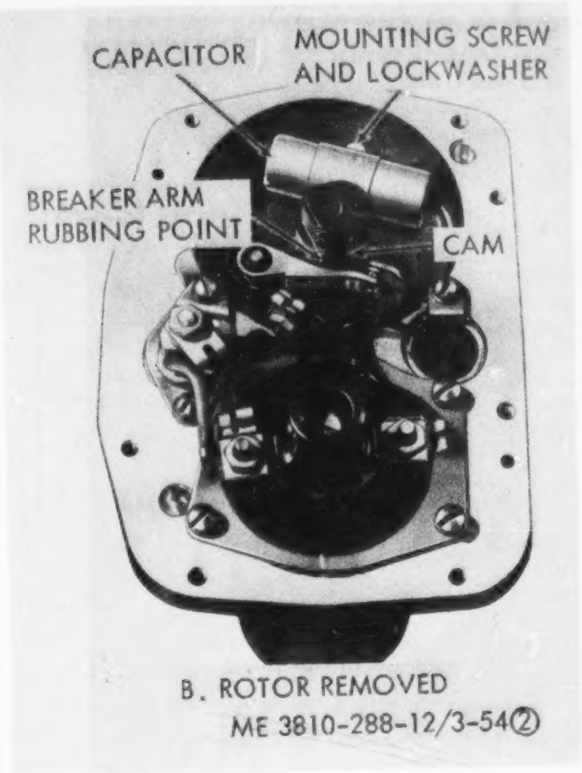
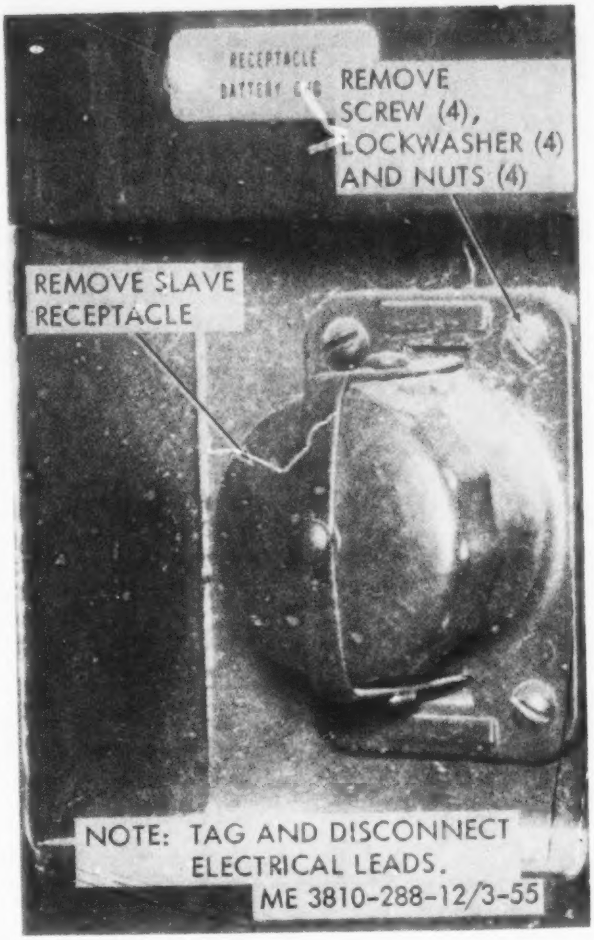

CAPACITOR
MOUNTING SCREW AND LOCKWASHER
BREAKER ARM RUBBING POINT
CAM
B. ROTOR REMOVED
ME 3810-288-12/3-54②

Figure 3-54. Distributor adjustment. (Sheet 2 of 2)

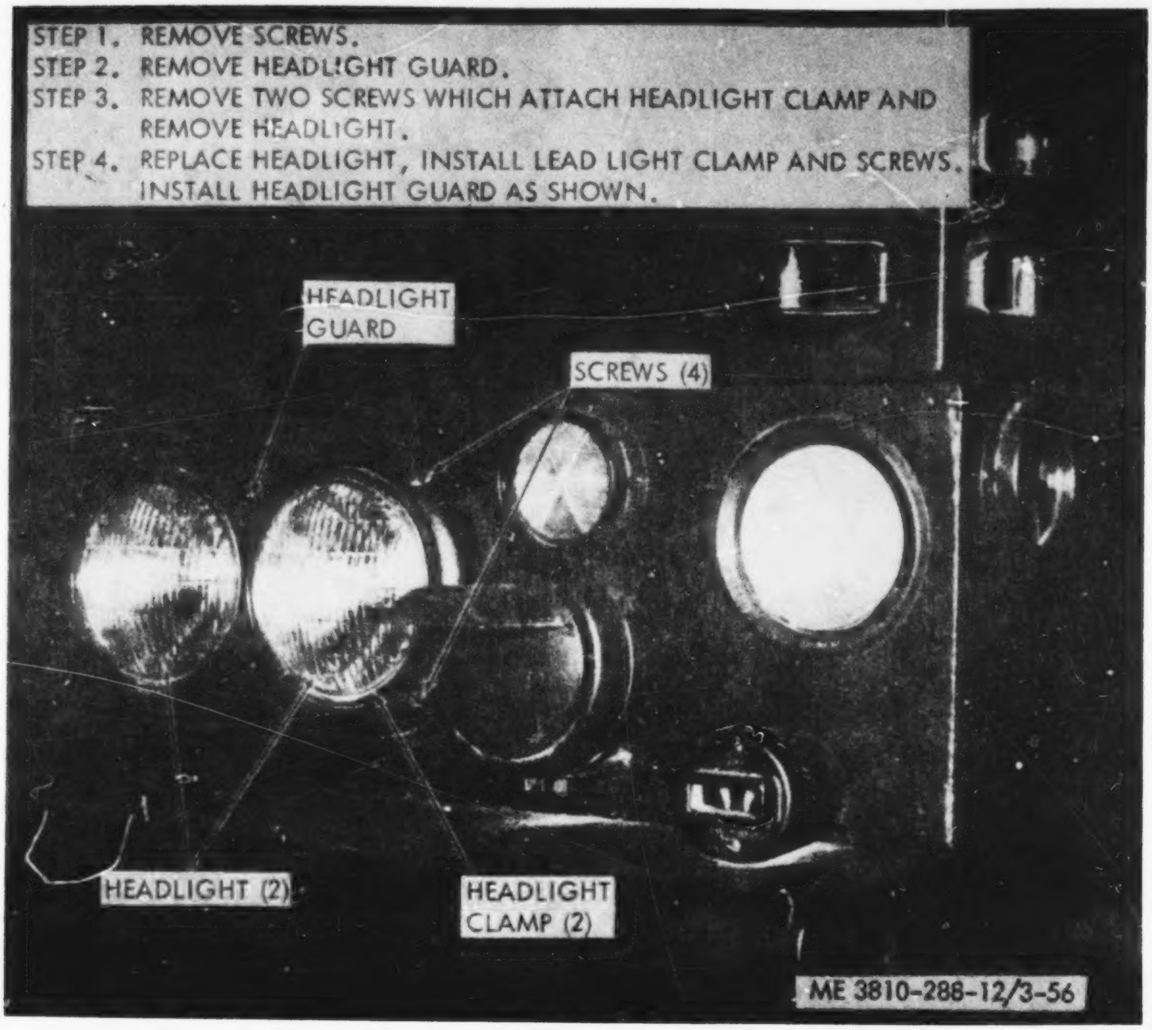

RECEPTACLE
BATTERY CHG
ME 3810-288-12/3-55

REMOVE SCREW (4), LOCKWASHER (4) AND NUTS (4)

REMOVE SLAVE RECEPTACLE

NOTE: TAG AND DISCONNECT ELECTRICAL LEADS.

Figure 3-55. Slave receptacle, removal and installation.



STEP 1. REMOVE SCREWS.
STEP 2. REMOVE HEADLIGHT GUARD.
STEP 3. REMOVE TWO SCREWS WHICH ATTACH HEADLIGHT CLAMP AND REMOVE HEADLIGHT.
STEP 4. REPLACE HEADLIGHT, INSTALL LEAD LIGHT CLAMP AND SCREWS. INSTALL HEADLIGHT GUARD AS SHOWN.

HEADLIGHT GUARD
SCREWS (4)
HEADLIGHT (2)
HEADLIGHT CLAMP (2)
ME 3810-288-12/3-56

Figure 3-56. Headlights, replacement.

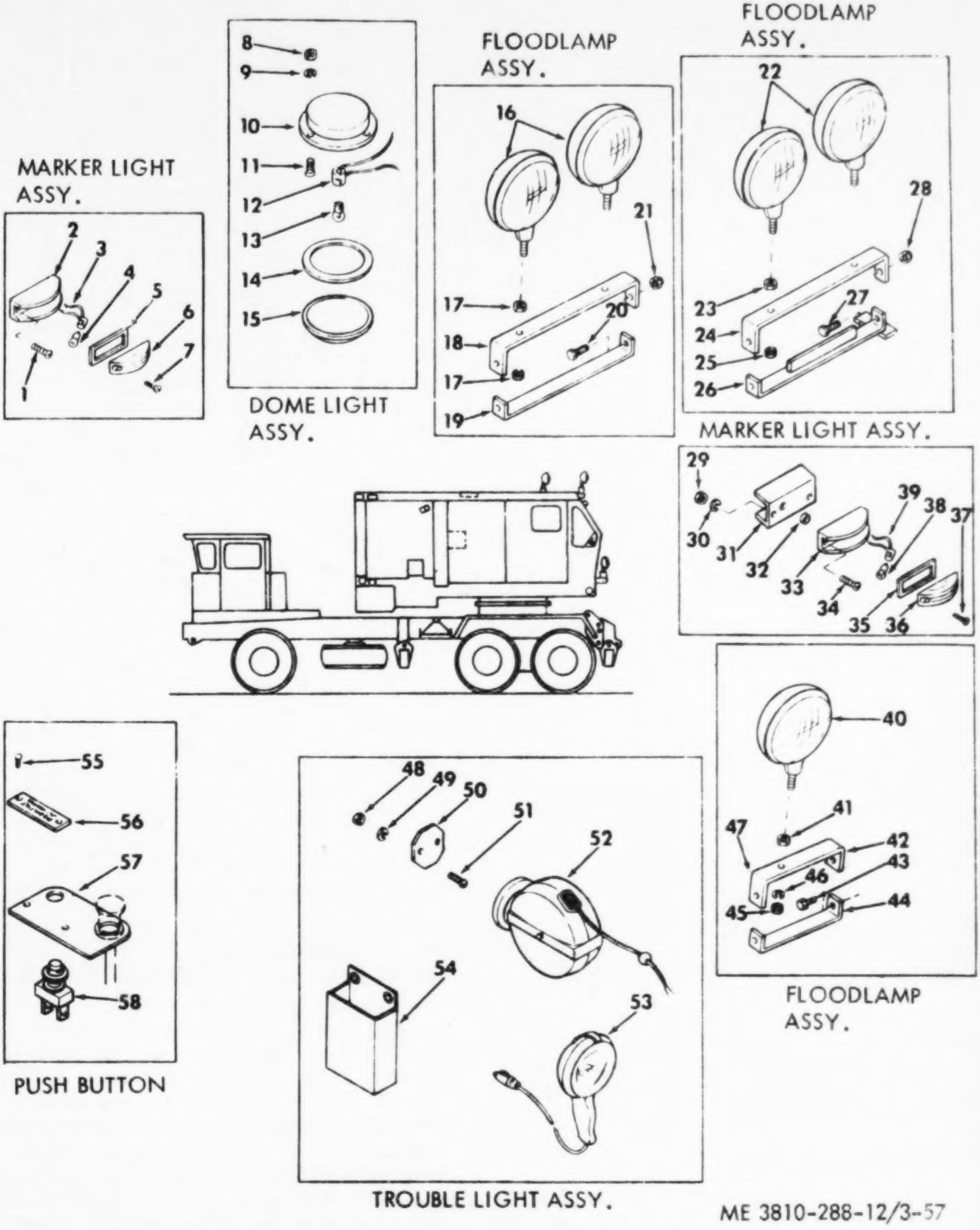

MARKER LIGHT ASSY.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
DOME LIGHT ASSY.
FLOODLAMP ASSY.
16
17
18
19
20
21
FLOODLAMP ASSY.
22
23
24
25
26
27
28
MARKER LIGHT ASSY.
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
FLOODLAMP ASSY.
55
56
57
58
PUSH BUTTON
48
49
50
51
52
53
54
TROUBLE LIGHT ASSY.
ME 3810-288-12/3-57

Figure 3-57. Marker lights, dome lights, flood lights, and trouble lights, removal and replacement.

1. Screw
2. Bracket
3. Socket
4. Lamp
5. Gasket
6. Lens
7. Screw
8. Nut
9. Lockwasher
10. Base
11. Screw
12. Socket
13. Lamp
14. Ring
15. Lens
16. Floodlamp
17. Nut
18. Bracket
19. Bracket
20. Screw
21. Nut
22. Floodlamp
23. Nut
24. Bracket
25. Nut
26. Bracket
27. Screw
28. Nut
29. Nut
30. Lockwasher
31. Bracket
32. Washer
33. Bracket
34. Screw
35. Gasket
36. Lens
37. Screw
38. Bulb
39. Socket
40. Floodlamp
41. Nut
42. Bracket
43. Screw
44. Bracket
45. Nut
46. Lockwasher
47. Bracket
48. Nut
49. Lockwasher
50. Plate
51. Screw
52. Reel assembly
53. Lamp assembly
54. Lamp container
55. Screw
56. Plate
57. Bracket
58. Pushbutton

Figure 3-57. Marker lights, dome lights, flood lights, and trouble lights, removal and replacement.

3-50. Propeller Shaft

a. Service. Lubricate the propeller shaft with the lubricant and at the intervals shown in the lubrication order.

b. Replacement. Refer to figure 3-61 and remove or replace the propeller shaft.

3-51. Cab Assembly

a. Doors. Refer to figure 3-62 and replace a damaged door. Also refer to figure 3-99, which is an exploded view of the cab assembly.

b. Glass.

(1) *Removal.* The only reason for removing glass is when the glass is broken. Break out the remaining glass, being very careful to avoid personal injury. Place masking tape on the piece of glass to be broken out to prevent flying glass. Remove the weatherstripping around the glass.

(2) *Installation.*

(*a*) Start the rubber weatherstripping as shown in figure 3-63. Go all the way around the window and force the ends into place, touching each other.

(*b*) Install the glass in one of the lower corners of the new weatherstrip.

(*c*) Moisten the weatherstrip with soapy water.

(*d*) Insert a suitable locking tool similar to the one illustrated in figure 3-63 and pull it around the complete weatherstrip to lock the glass in place. Do not begin the locking operation at the butt joint of the weatherstrip. Be sure to avoid excessive force.

3-52. Operator's Seat

The operator's seat is readily removable. Refer to figure 3-64 and remove or replace the operator's seat.

3-53. Heater

a. General. The upper heater [illegible] of the hot water-air blower type. Hot water [illegible]om the upper engine radiator is piped to the heater through the input line shown in figure 3-65 where it passes through metal coils. This hot water serves as the means of heating cold air drawn by an electric motor driven fan. The heated air then passes through the heater flexible hose to the sheet metal heater duct located on the right side of the operator's cab wall.

b. Removal. Remove the heater as follows: See figure 3-65.

(1) Open the petcock on the side of the heater and drain the coolant below the level of the heater. Open coolant drains to assist in draining coolant.

(2) Remove flexible hose clamp.

(3) Disconnect input hose and output hose by removing hose clamps.

(4) Remove the heater cover by removing the capscrews (4) which secure it to the deck plate.

c. Repair. Refer to the heater trouble shooting chart, Table 3-6 for heater repair procedures.

3-54. Hydraulic System

a. General. The hydraulic system for this machine consists basically of a number of individual systems, each of which is designed to provide the hydraulic power required to perform one specific function. Fluid supply for the entire system is supplied from one reservoir and one manifold, as illustrated in figure 3-66. From the manifold, fluid is supplied to an individual master cylinder for each clutch or brake operated by the various control levers and pedals. Refer to paragraph 2-14 for a listing of the various controls. When the operator moves a control lever or pedal, mechan-

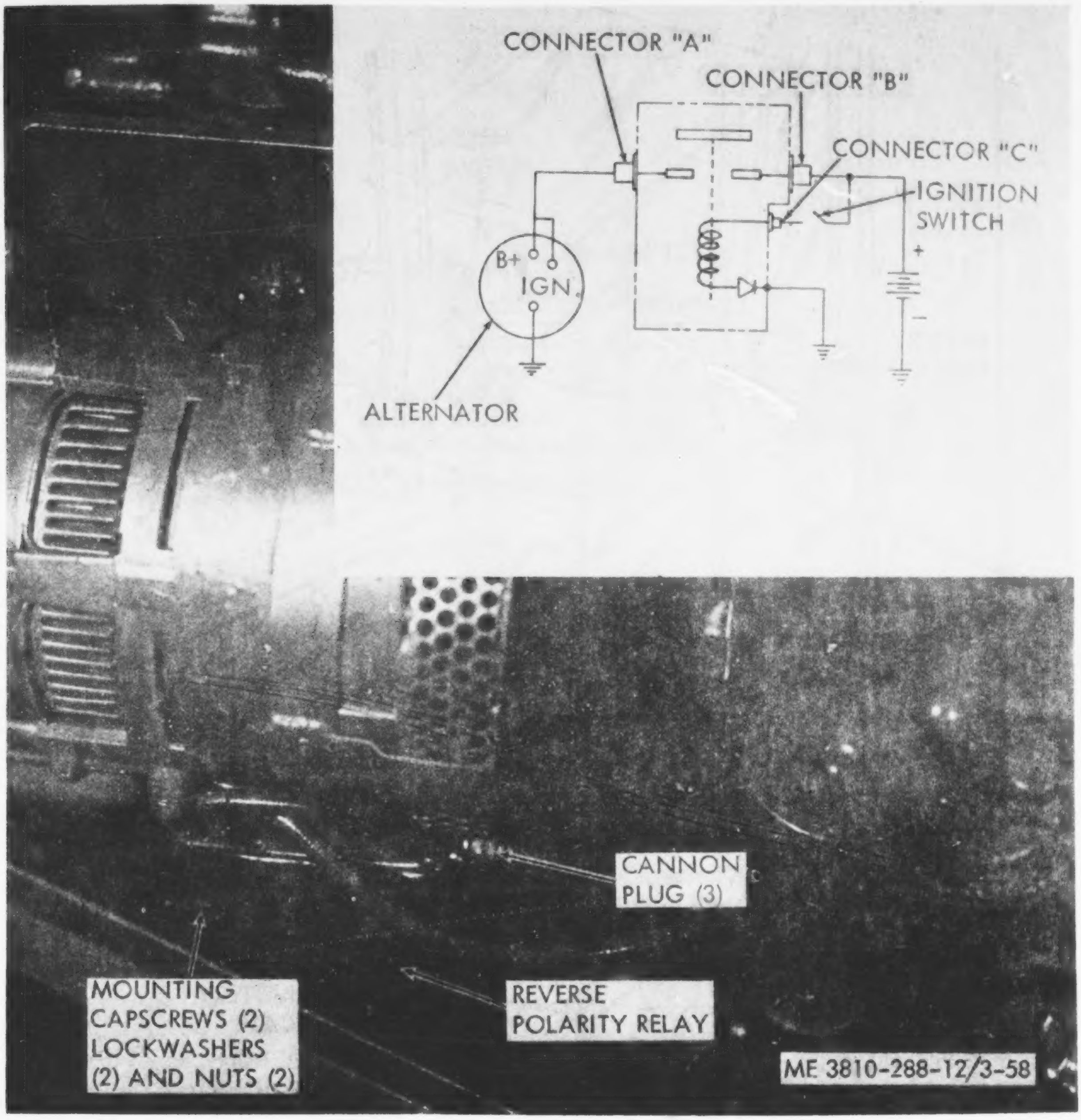

CONNECTOR "A"
CONNECTOR "B"
CONNECTOR "C"
IGNITION SWITCH
B+
IGN.
+
−
ALTERNATOR
CANNON PLUG (3)
MOUNTING CAPSCREWS (2) LOCKWASHERS (2) AND NUTS (2)
REVERSE POLARITY RELAY
ME 3810-288-12/3-58

Figure 3-58. Reverse polarity relay, testing, removal and replacement.

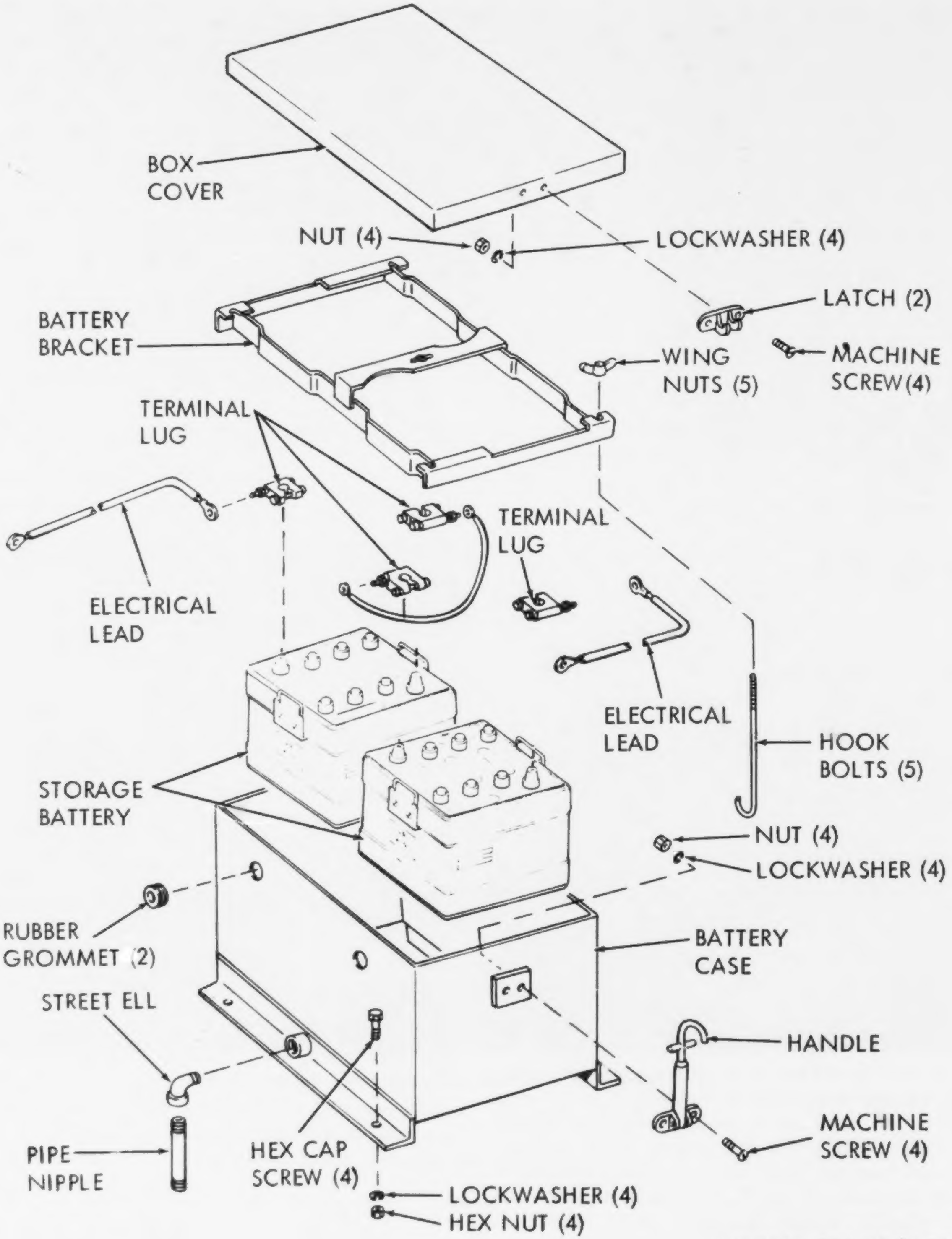
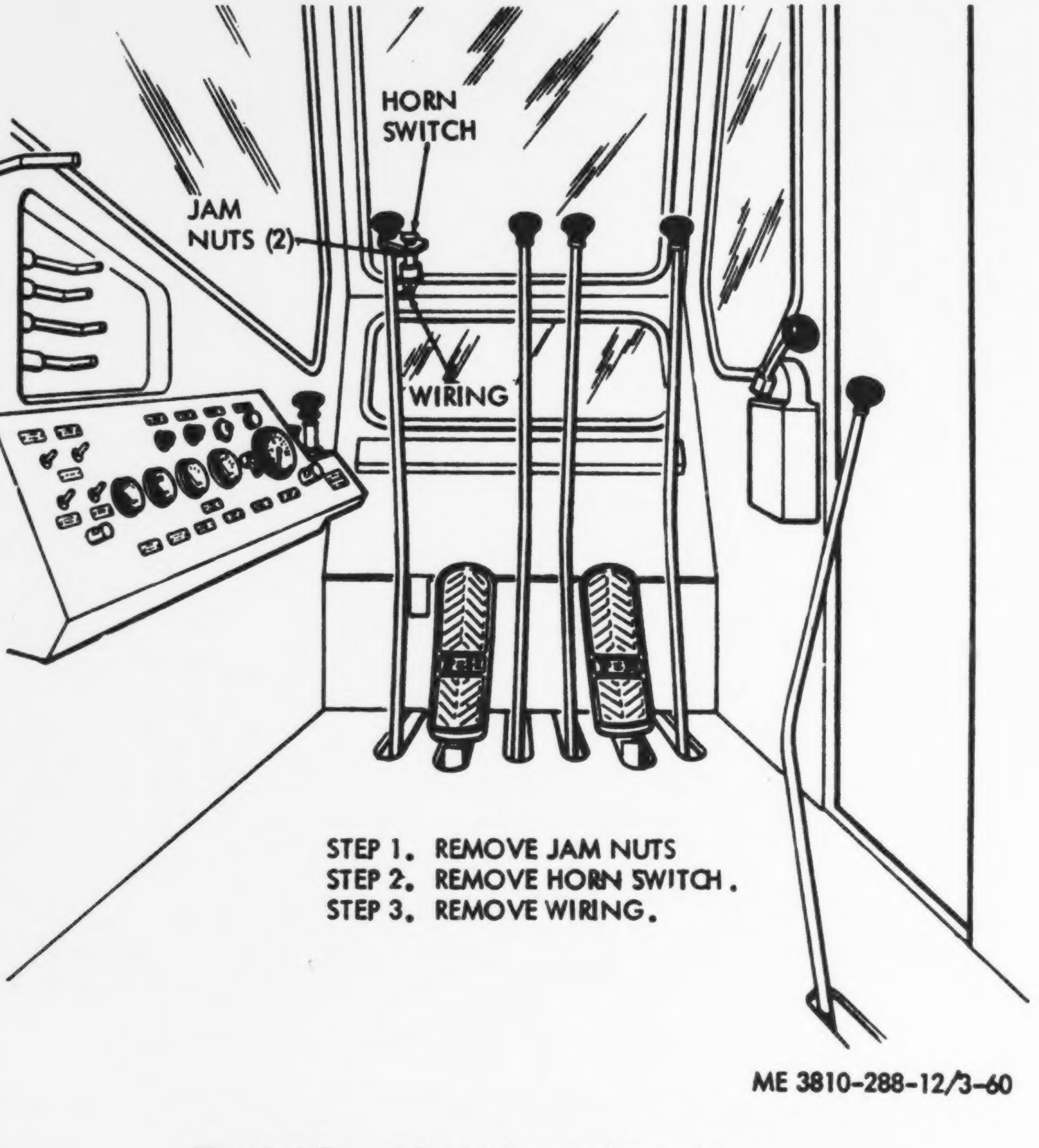

BOX COVER
NUT (4)
LOCKWASHER (4)
LATCH (2)
BATTERY BRACKET
WING NUTS (5)
MACHINE SCREW(4)
TERMINAL LUG
TERMINAL LUG
ELECTRICAL LEAD
ELECTRICAL LEAD
HOOK BOLTS (5)
STORAGE BATTERY
NUT (4)
LOCKWASHER (4)
RUBBER GROMMET (2)
BATTERY CASE
STREET ELL
HANDLE
MACHINE SCREW (4)
PIPE NIPPLE
HEX CAP SCREW (4)
LOCKWASHER (4)
HEX NUT (4)
ME 3810-288-12/3-59

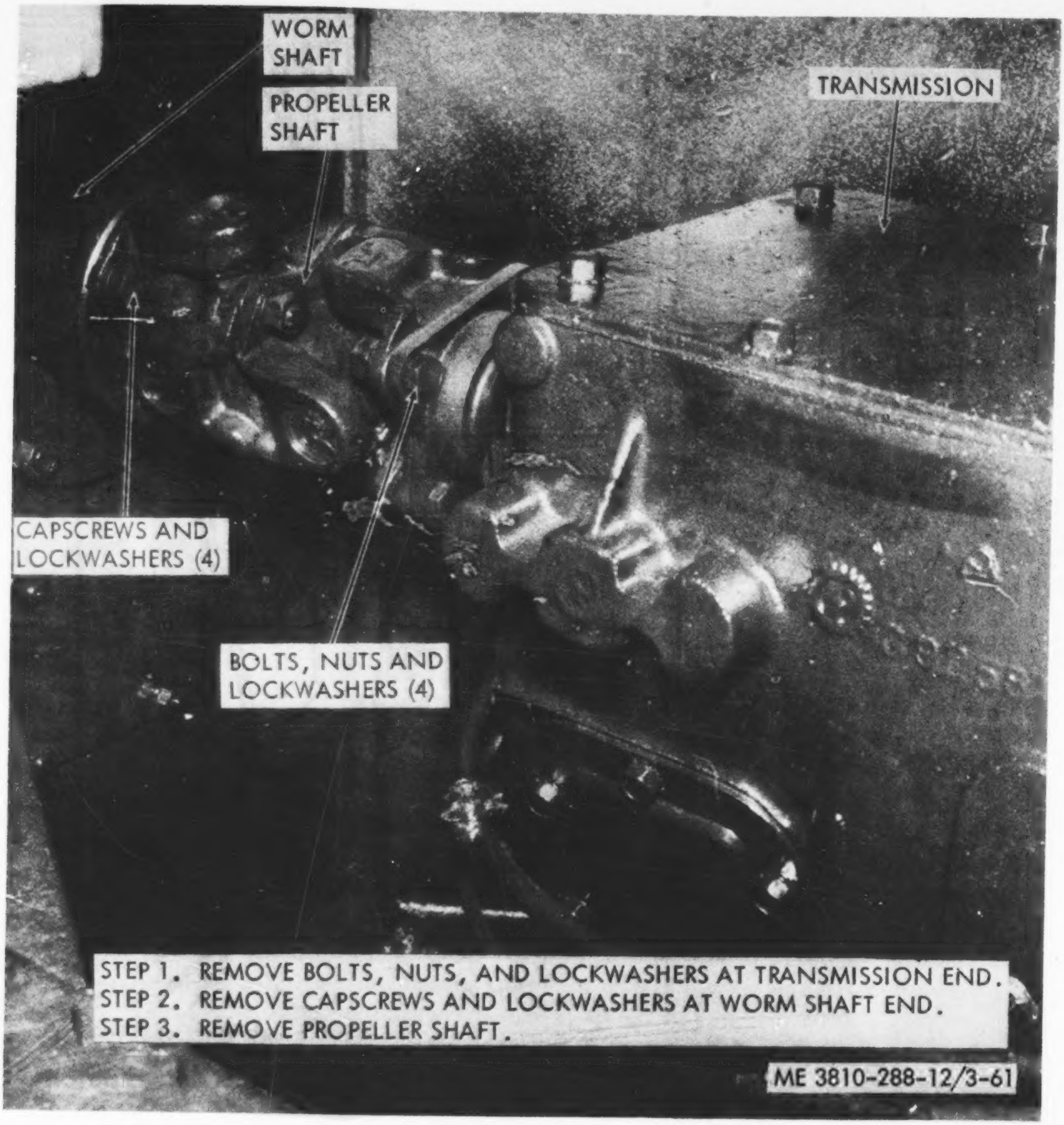
Figure 3-59. Batteries, cables, and battery box, removal, and replacement.


HORN SWITCH
JAM NUTS (2)
WIRING

STEP 1. REMOVE JAM NUTS
STEP 2. REMOVE HORN SWITCH.
STEP 3. REMOVE WIRING.

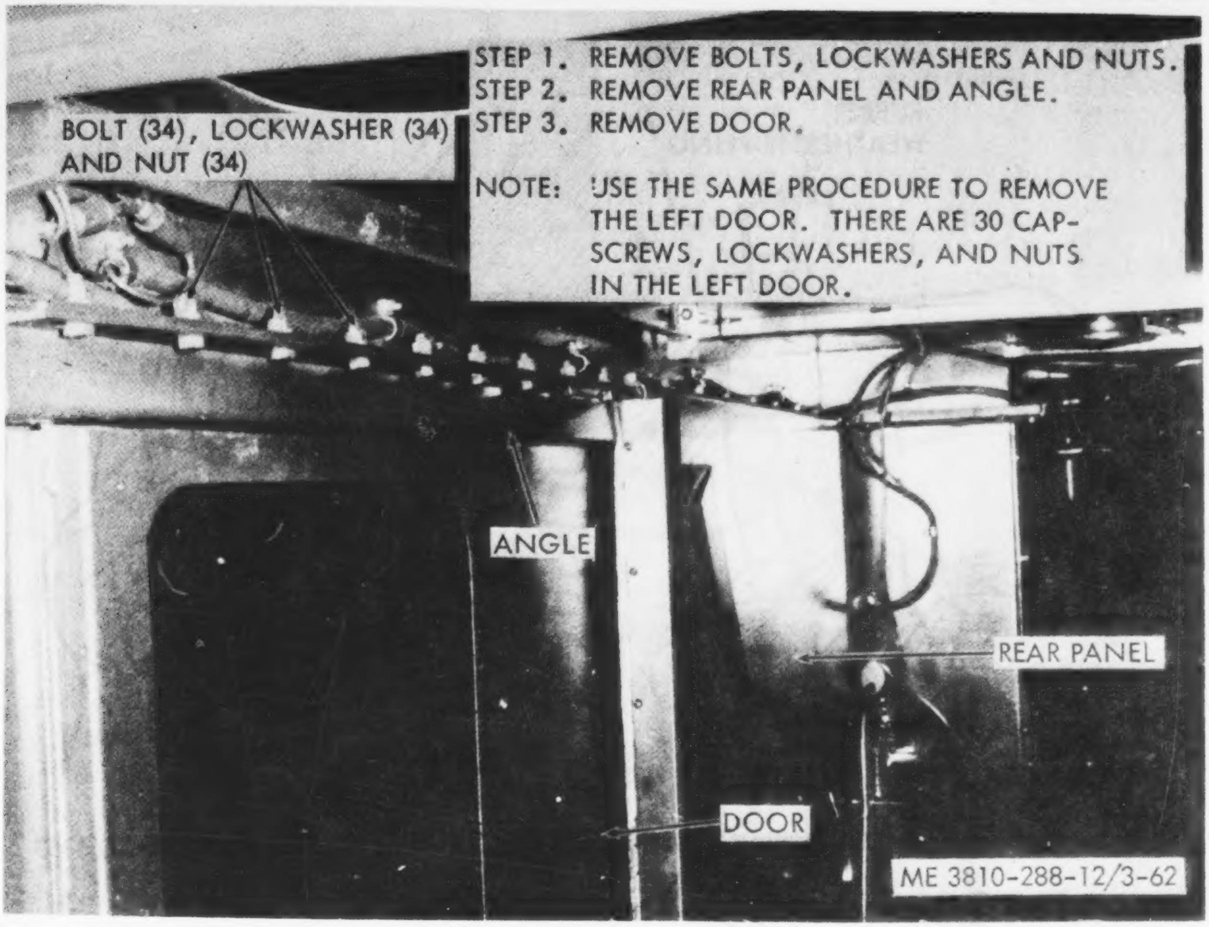
ME 3810-288-12/3-60

Figure 3-60. Horn switch and wiring, removal and replacement.


WORM SHAFT
PROPELLER SHAFT
TRANSMISSION
CAPSCREWS AND LOCKWASHERS (4)
BOLTS, NUTS AND LOCKWASHERS (4)
ME 3810-288-12/3-61

STEP 1. REMOVE BOLTS, NUTS, AND LOCKWASHERS AT TRANSMISSION END.
STEP 2. REMOVE CAPSCREWS AND LOCKWASHERS AT WORM SHAFT END.
STEP 3. REMOVE PROPELLER SHAFT.

Figure 3-61. Propeller shaft, removal and replacement.

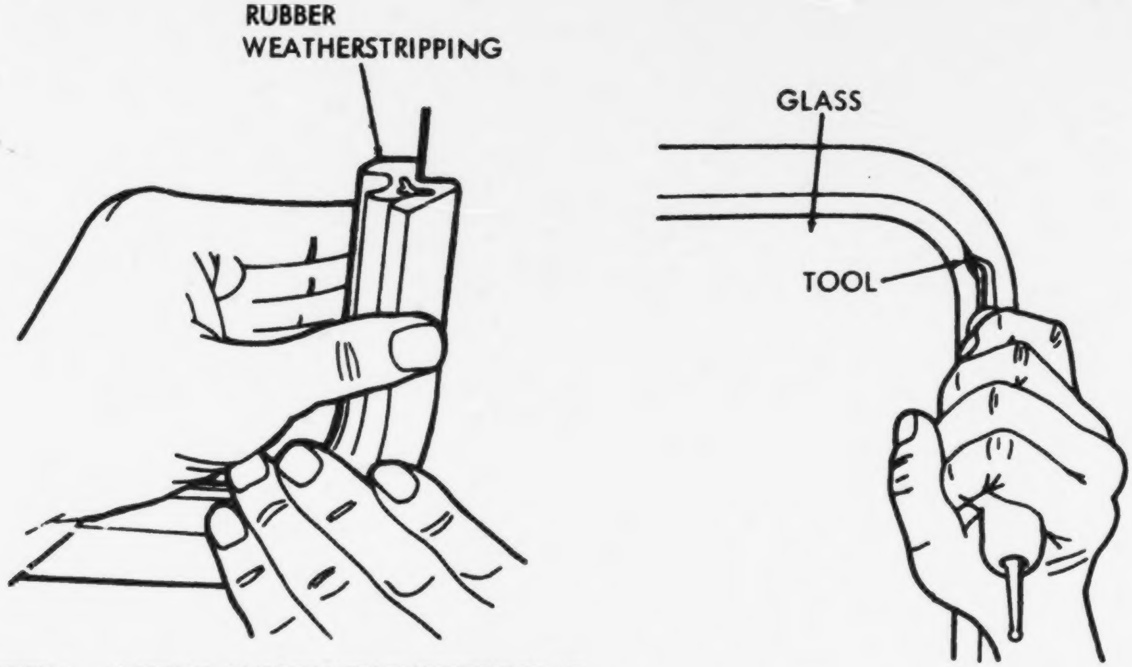


STEP 1. REMOVE BOLTS, LOCKWASHERS AND NUTS.
STEP 2. REMOVE REAR PANEL AND ANGLE.
STEP 3. REMOVE DOOR.

NOTE: USE THE SAME PROCEDURE TO REMOVE THE LEFT DOOR. THERE ARE 30 CAPSCREWS, LOCKWASHERS, AND NUTS IN THE LEFT DOOR.

BOLT (34), LOCKWASHER (34) AND NUT (34)
ANGLE
REAR PANEL
DOOR
ME 3810-288-12/3-62

Figure 3-62. Cab door assembly, removal and replacement.

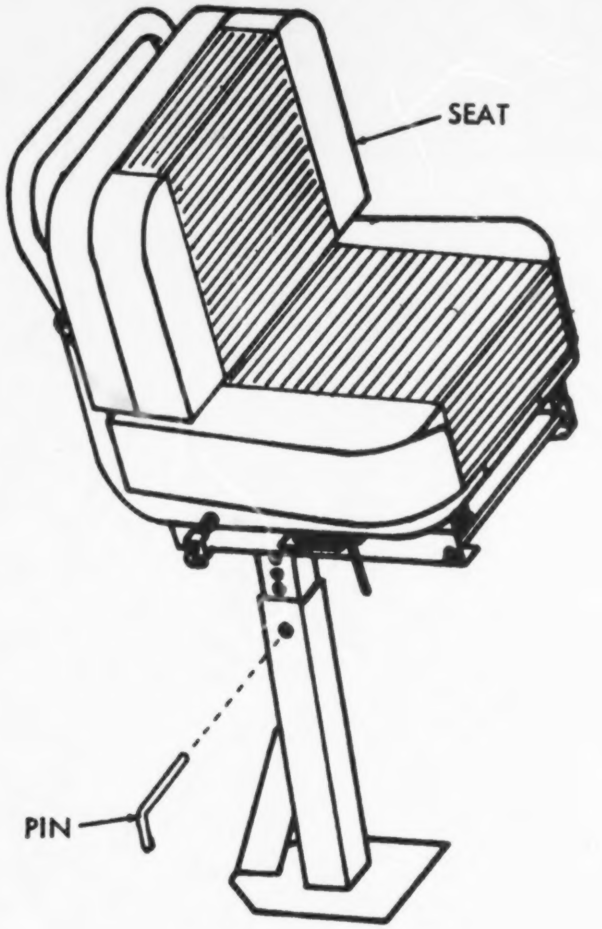


STEP 1. INSTALL RUBBER WEATHERSTRIPPING.
STEP 2. INSTALL GLASS.
STEP 3. LOCK WEATHERSTRIPPING, USING SUITABLE TOOL.

ME 3810-288-12/3-63

Figure 3-63. Window glass, installation.

ical force is supplied to the piston of the master cylinder connected to that lever or pedal. This force is converted into hydraulic pressure between the master cylinder piston and the clutch or brake cylinder. The force will cause the clutch or brake cylinder piston to move outward. This movement forces the clutch or brake band or shoes to contact the drum, engaging the clutch or brake. When the operator releases the control lever or pedal, springs in the master cylinders and hydraulic cylinders return the pistons to the released position, and the brake or clutch will disengage.



STEP 1. REMOVE PIN.
STEP 2. REMOVE SEAT.

ME 3810-288-12/3-64

Figure 3-64. Operator's seat, removal and replacement.

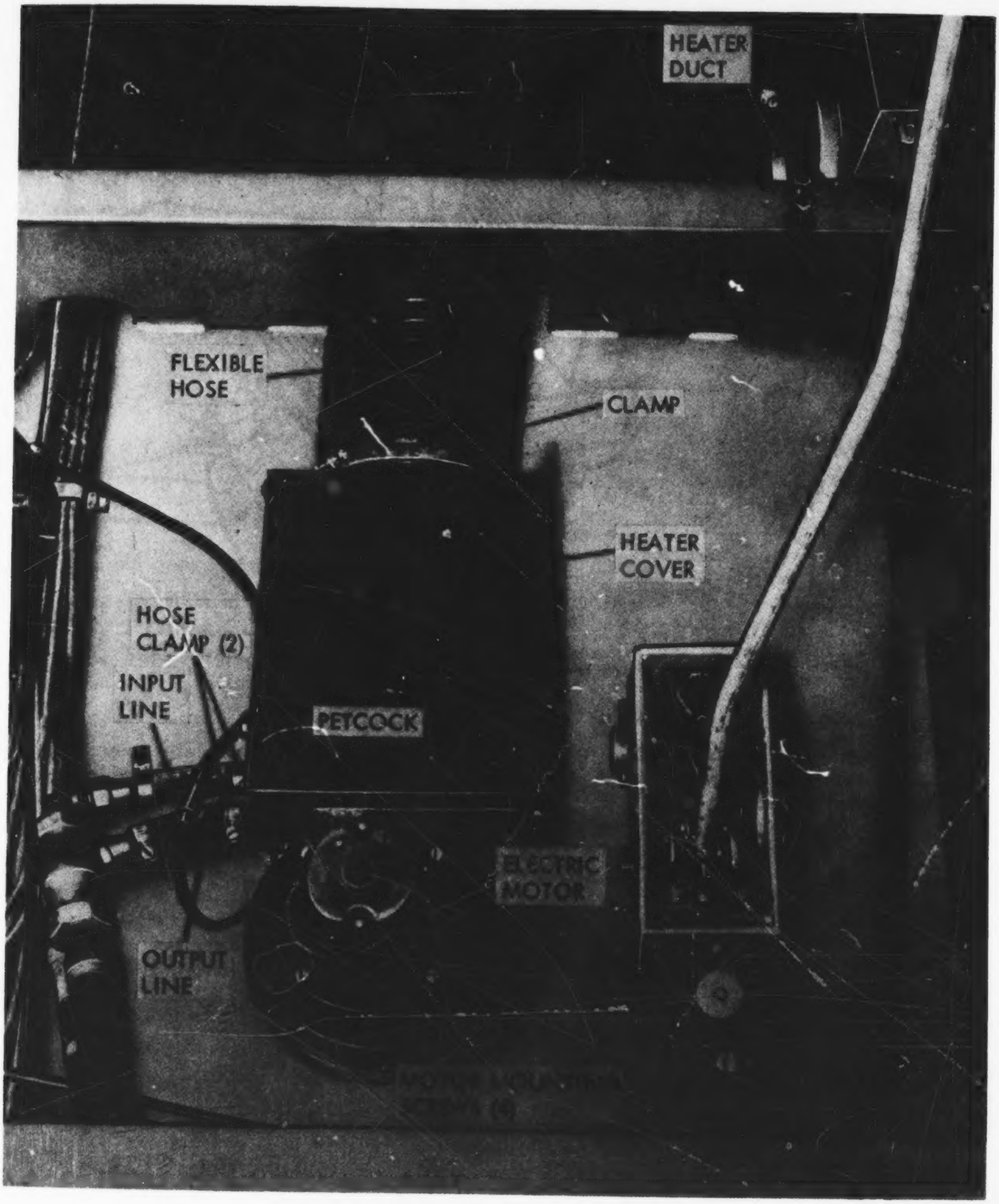

HEATER DUCT
FLEXIBLE HOSE
CLAMP
HEATER COVER
HOSE CLAMP (2)
INPUT LINE
PETCOCK
ELECTRIC MOTOR
OUTPUT LINE
MOTOR MOUNTING SCREWS (4)

Figure 3-65. Heater, repair, removal and replacement.

Table 3-6. Heater Trouble Shooting Chart

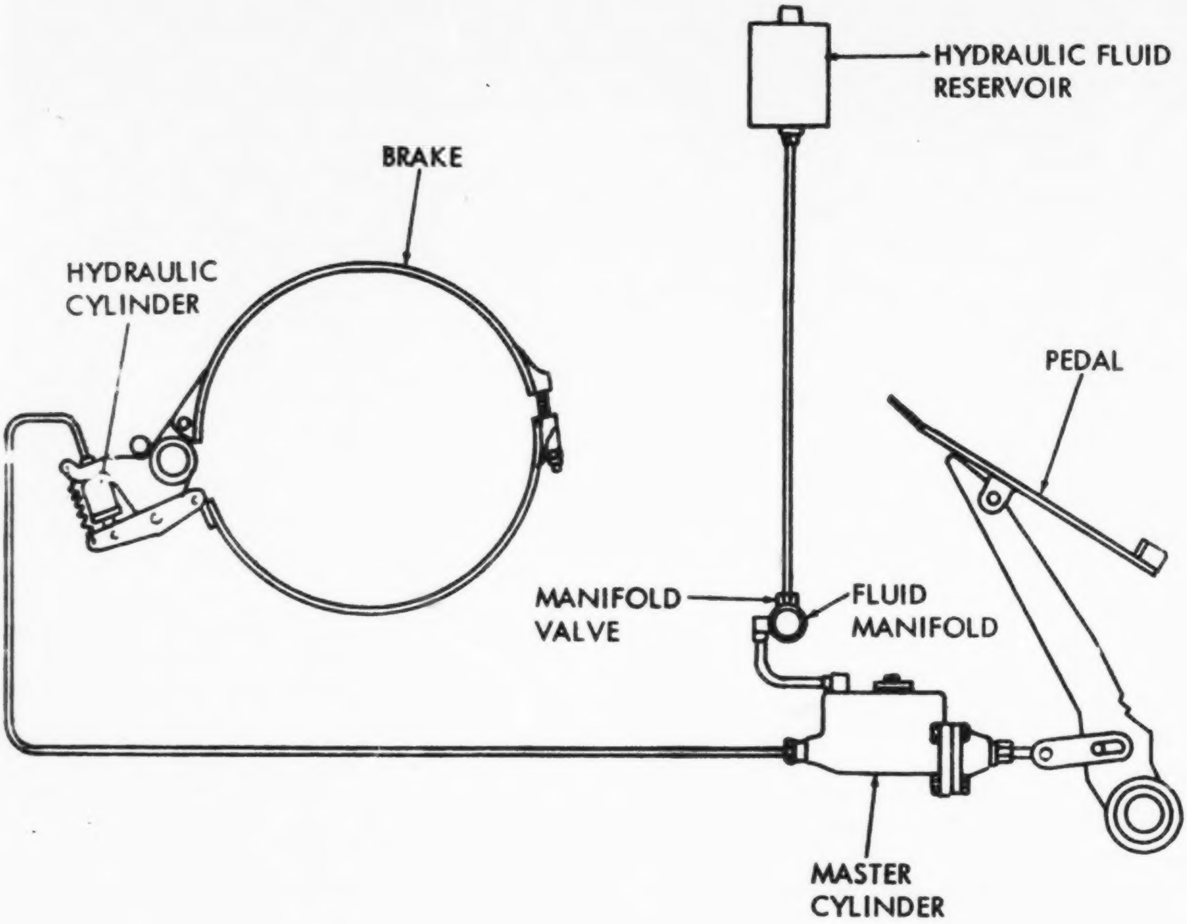
Trouble	Probable cause	Possible remedy
Heater motor inoperative	1. Wiring faulty. 2. Heater motor faulty.	1. Repair or replace wiring. 2. Replace heater motor (fig. 3-65).
Heater delivers cold air	1. Engine thermostat stuck. 2. Heater hose blocked. 3. Air lock in water line to heater. 4. Dirt on outside of coil. 5. Sediment in inside of coil.	1. Replace engine thermostat (para 3-48). 2. Replace or repair blocked hose. 3. Disconnect heater hose and drain line until air lock is bled from system. 4. Remove cover and clean outside of coil. 5. Remove input and output hoses and flush coil with suitable solvent.
Heater does not deliver air	1. Heater motor inoperative. 2. Fan loose on electric motor shaft.	1. See above. 2. Remove motor and tighten fan on motor shaft.
Heater leaks	Broken coil.	Replace coil.

b. Hoses, Fittings, and Tubing.

(1) *Repair.* Refer to figure 3-67 and tighten any loose fitting, hose, or tube which is causing the hydraulic system to leak. Be sure to wipe up any spilled hydraulic fluid. If any brake or clutch lining is touched by the spilled hydraulic fluid, refer to the appropriate paragraph and replace the brake or clutch lining. Hydraulic fluid is a lubricant, and will cause otherwise serviceable brake or clutch linings to slip.

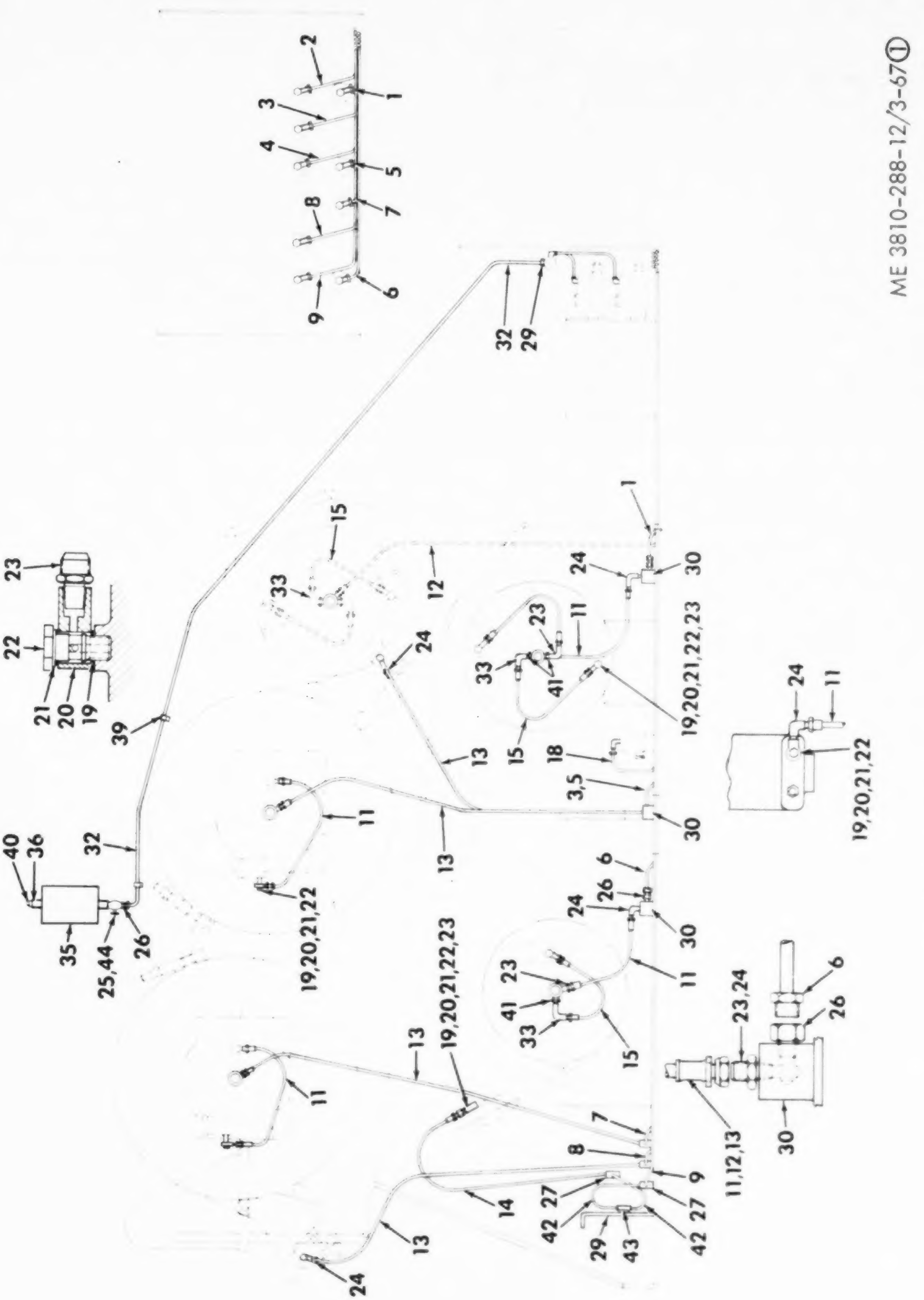
(2) *Replacement.* Close the shutoff valve at the hydraulic reservoir shown in figure 3-68. Then, refer to figure 3-67 and remove and replace any worn or damaged hydraulic hose, fitting, or tube.

Note. Always cap or plug each end of the hose or fitting when a piece has been removed, to prevent dirt from entering the hydraulic system and to prevent the loss of unnecessary amounts of hydraulic fluid. Refill the hydraulic reservoir and bleed the system as described in the following, when the damaged item has been replaced.


HYDRAULIC FLUID RESERVOIR
BRAKE
HYDRAULIC CYLINDER
PEDAL
MANIFOLD VALVE
FLUID MANIFOLD
MASTER CYLINDER

ME 3810-288-12/3-66

Figure 3-66. Hydraulic system, schematic diagram.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ME 3810-288-12/3-67①
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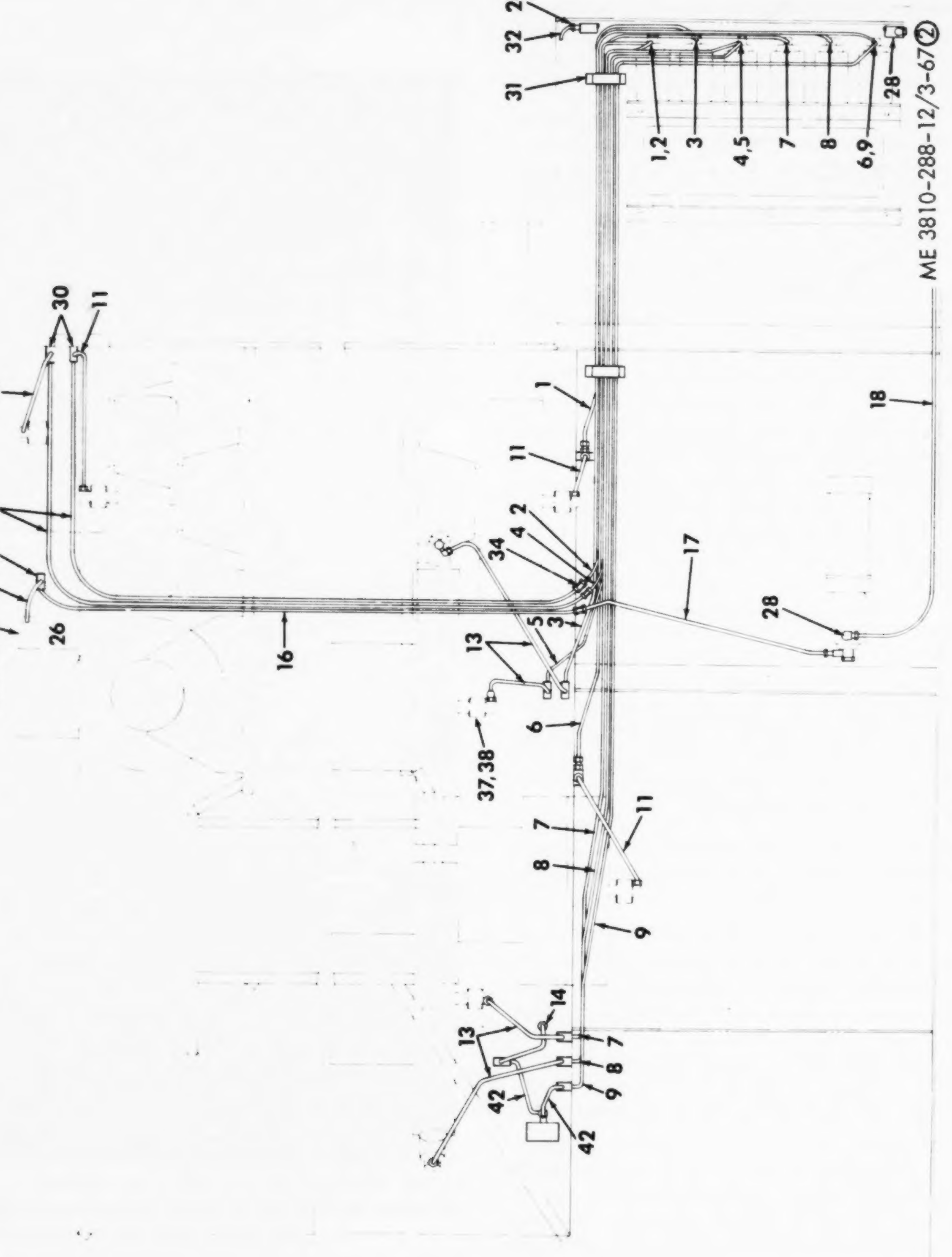
Figure 3-67. Hydraulic hoses, fittings, and tubing, repair and replacement.
(Sheet 1 of 2)

1. Right-hand swing clutch line
2. Front drum brake line
3. Front drum brake line
4. Reversing clutch line
5. Front drum clutch line
6. Boom hoist clutch line
7. Rear drum clutch line
8. Rear drum brake line
9. Boom hoist brake line
10. Crossover line
11. Swing and boom hoist clutch hose
12. Reversing clutch hose
13. Clutch and brake hose
14. Brake cylinder hose
15. Hydraulic hose
16. Crossover line
17. Swing brake line
18. Swing brake line
19. Gasket
20. Fitting
21. Gasket
22. Fitting bolt
23. Male connector
24. Elbow
25. Reducing bushing
26. Inverted male connector
27. Elbow
28. Elbow
29. Displacement cylinder
30. Fitting mounting bracket
31. Hydraulic line clamp
32. Supply tank line
33. Male Elbow
34. Union
35. Supply tank
36. Reducing bushing
37. High pressure hydraulic swivel
38. Swivel joint washer
39. Supply line clamp
40. Air vent
41. Reducer
42. Boom hoist brake line
43. Adapter
44. Shutoff cock

Figure 3-67. Hydraulic hoses, fittings, and tubing, repair and replacement.
(Sheet 1 of 2)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ME 3810-288-12/3-67②
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Figure 3-67. Hydraulic hoses, fittings, and tubing, repair and replacement. (Sheet 2 of 2)

(3) *Bleeding.* When air is present in the hydraulic system, the controls are "spongy" and do not operate to hold the brakes and clutches as firmly as when air is absent. All air must be removed before the controls will operate properly. Bleed the system as follows:

Note. Containers must be perfectly clean and no mineral oil can be used in the hydraulic system.

(*a*) Fill the reservoir (fig. 3-68) with the proper fluid and check the level frequently during the following steps. Keep the reservoir full.

(*b*) Open the manifold valve (fig. 3-66) and allow fluid to flow until no bubbles are present in the fluid coming out of the valve. Then close the manifold valve. Catch fluid in a clean jar and have a supply of rags available to catch leakage fluid.

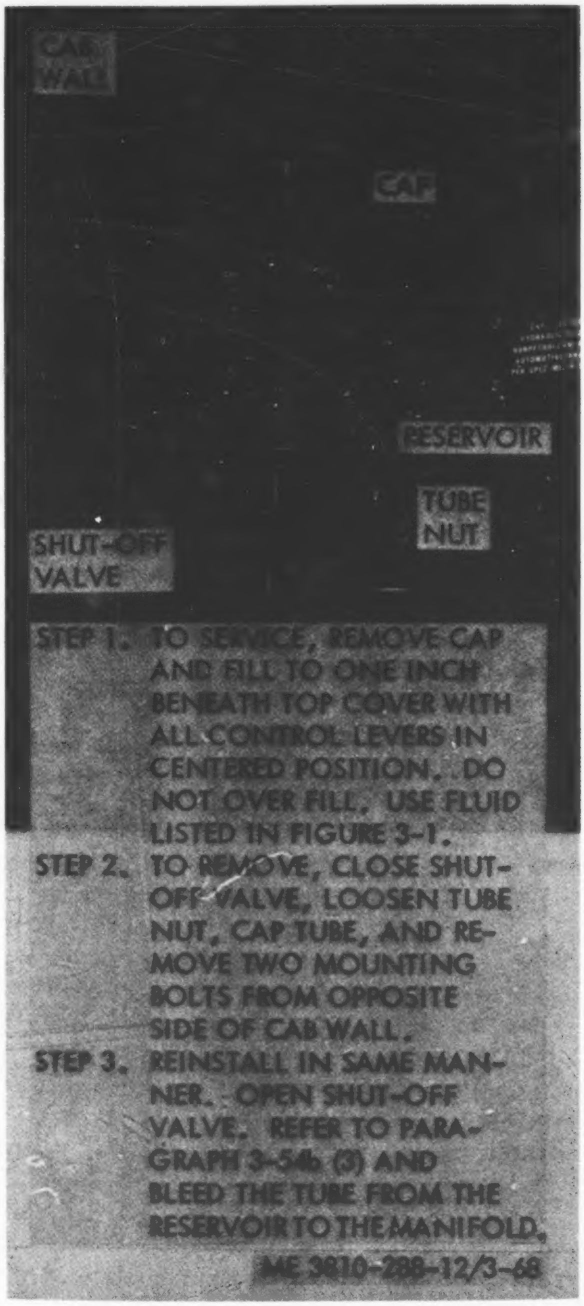
(*c*) Starting with the lower row of master cylinders, open the bleeder cap on the top of each master cylinder in turn, and bleed the fluid until no air is visible in the fluid. Then close the bleeder cap, while solid, bubble-free fluid is being expelled.

(*d*) Attach a bleeder hose, which may be a length of any clear plastic hose, to the bleed valve of the lowest clutch or brake cylinder to be bled. Refer to figure 3-69. Bleed the air from each of the hydraulic cylinders on the machine, beginning with the lowest cylinder and working toward the highest cylinder. Keep the hose submerged in fluid at the bottom of the jar to prevent air from reentering the system.

Note. Cylinder bleed fittings must be at their highest point of travel. They may be positioned by "tapping" the engine start pushbutton.

(*e*) Work each of the controls slowly and note the action of the brake or clutch. If any control still feels "spongy", slight pressure may be applied to the operating lever or pedal to assist in expelling more fluid from the open bleed screw. Be sure to close the bleed screw before the lever or pedal reaches the end of its stroke, or air will be sucked into the system through the bleed screw.

c. Hydraulic Cylinders (Brake or Clutch). Close the hydraulic reservoir shutoff valve shown in figure 3-68. Then refer to figure 3-70 and remove and replace a hydraulic cylinder. Use the same procedure for all hydraulic brake and clutch cylinders. Note that front or rear drum clutch cylinders can be positioned for removal by "tapping" the engine start pushbutton with the ignition switch in the OFF position.



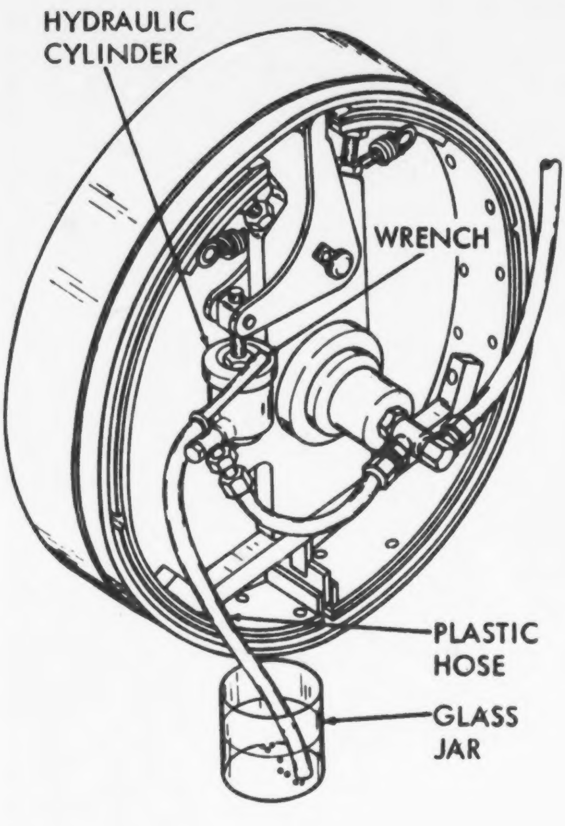
STEP 1. TO SERVICE, REMOVE CAP AND FILL TO ONE INCH BENEATH TOP COVER WITH ALL CONTROL LEVERS IN CENTERED POSITION. DO NOT OVER FILL. USE FLUID LISTED IN FIGURE 3-1.

STEP 2. TO REMOVE, CLOSE SHUT-OFF VALVE, LOOSEN TUBE NUT, CAP TUBE, AND REMOVE TWO MOUNTING BOLTS FROM OPPOSITE SIDE OF CAB WALL.

STEP 3. REINSTALL IN SAME MANNER. OPEN SHUT-OFF VALVE. REFER TO PARAGRAPH 3-54b (3) AND BLEED THE TUBE FROM THE RESERVOIR TO THE MANIFOLD.

ME 3810-288-12/3-68

Figure 3-68. Hydraulic fluid reservoir, service, removal and replacement.



ME 3810-288-12/3-69

Figure 3-69. Hydraulic cylinder, bleeding procedure.

d. Master Cylinders. Refer to figure 3-71 and remove and replace a faulty master cylinder. Use the same procedure for all master cylinders.

e. Hydraulic Fluid Reservoir.

(1) *Service.* Service consists of keeping the hydraulic reservoir full of clean fluid of the type specified in the lubrication order.

(2) *Replacement.* Refer to figure 3-68 and remove and replace the hydraulic fluid reservoir.

3-55. Control Panel

a. Replacement. Refer to figure 3-72 and replace any faulty control panel mounted gauge, instrument, or switch.

b. Repair. Inspect cables for frayed insulation, broken wires, bent or broken lugs, or other damage. Repair or replace faulty wiring as necessary.

***Caution:* Disconnect battery cable at battery box (fig. 3-59) before removing control panel.**

3-56. Boom Hoist Drum Safety Pawl and Automatic Planetary Pawl Adjustment

a. Safety Pawl. Push the boom hoist drum pawl control (fig. 2-36) backward and check to see that the boom hoist safety pawl (fig. 3-73) engages the ratchet machined into the boom hoist drum. Pull the pawl control lever forward and check to see that the pawl disengages from the ratchet. If the pawl does not engage or disengage properly, refer to figure 3-73 and adjust.

b. Boom Hoist Automatic Planetary Pawls. The boom hoist automatic planetary pawls and the friction shoes which engage the pawls are illustrated in figure 3-74. The friction shoes automatically engage the planetary pawls when the boom is being lowered. The pawls should not ordinarily require adjustment. However, if the assembly has been disturbed, refer to figure 3-74 and adjust the automatic boom hoist pawl planetary pawls.

3-57. Shovel Front Attachment

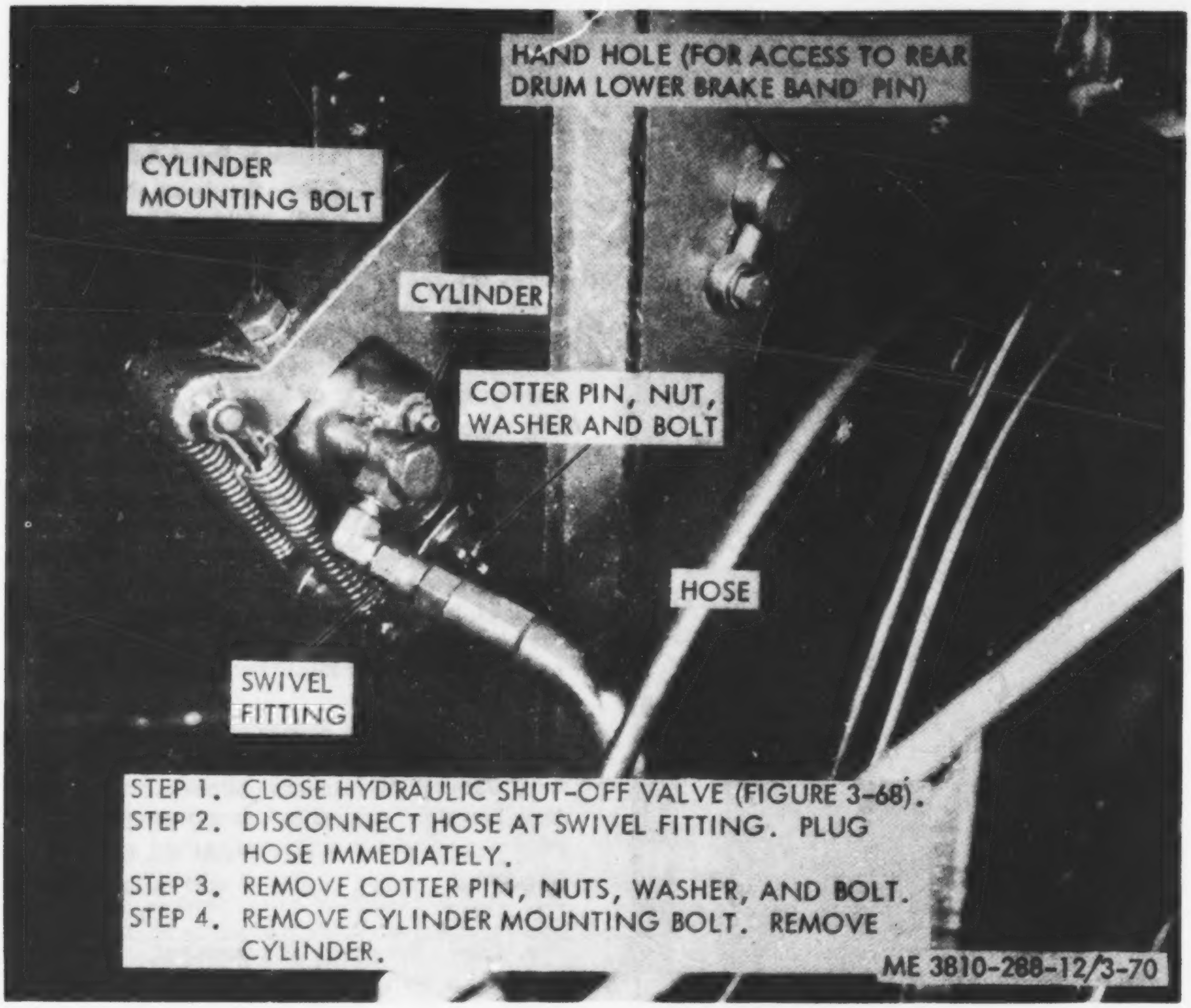
a. General. Maintenance allocated to organizational level is outlined in this paragraph.

b. Shovel Boom Repair. Paint the boom as required to prevent rust and corrosion. Refer to TM-9-213.

c. Idler Sprocket Replacement. The idler sprocket is bolted to the revolving frame as shown in figure 3-75. Refer to figure 3-75 and remove or replace the idler sprocket assembly, by removing or replacing the attaching bolts.

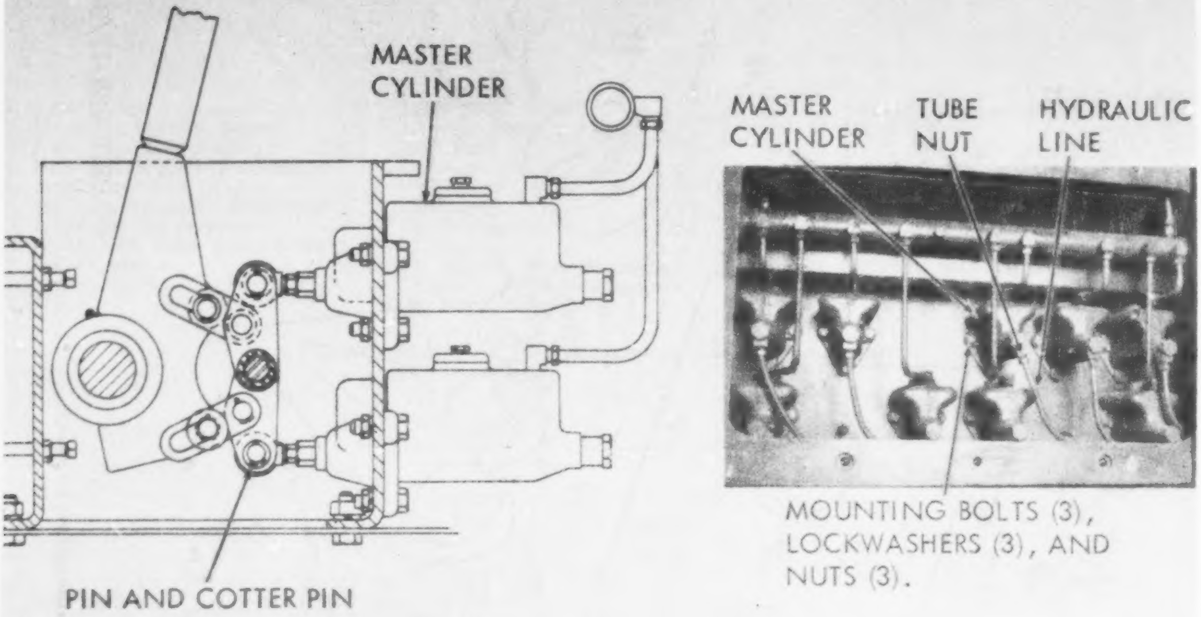
d. Crowd Chain, Replacement and Repair.

(1) *Replacement.* The crowd chain may be opened at any point for chain replacement. The easiest point will be at the boom foot drum sprocket, since the chain is accessible and supported by the sprocket. To open the chain, chisel off the cotter pin (fig. 3-75) and drive out the chain connecting pin at the point shown. To reinstall the chain, wrap the chain around the two sprockets as shown. Make sure the chain points in the direction shown in figure 3-76. Then support the chain on one side with a heavy hammer or steel plate while installing the connecting pin and a new cotter pin.


HAND HOLE (FOR ACCESS TO REAR DRUM LOWER BRAKE BAND PIN)
CYLINDER MOUNTING BOLT
CYLINDER
COTTER PIN, NUT, WASHER AND BOLT
HOSE
SWIVEL FITTING
ME 3810-288-12/3-70

STEP 1. CLOSE HYDRAULIC SHUT-OFF VALVE (FIGURE 3-68).
STEP 2. DISCONNECT HOSE AT SWIVEL FITTING. PLUG HOSE IMMEDIATELY.
STEP 3. REMOVE COTTER PIN, NUTS, WASHER, AND BOLT.
STEP 4. REMOVE CYLINDER MOUNTING BOLT. REMOVE CYLINDER.

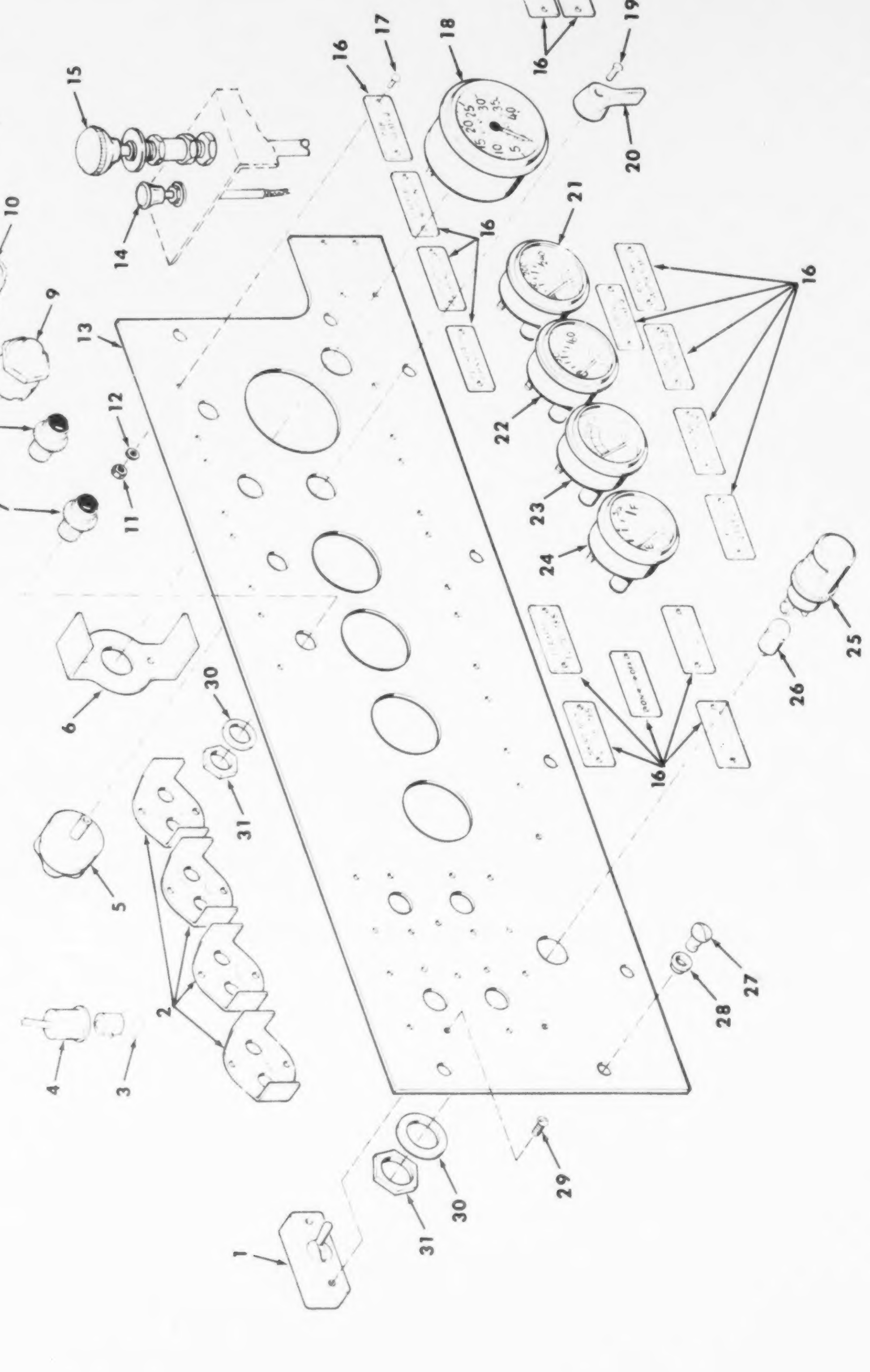
Figure 3-70. Hydraulic cylinders, removal and replacement.


MASTER CYLINDER
PIN AND COTTER PIN
MASTER CYLINDER
TUBE NUT
HYDRAULIC LINE
MOUNTING BOLTS (3), LOCKWASHERS (3), AND NUTS (3).

STEP 1. CLOSE HYDRAULIC SHUT-OFF VALVE (FIGURE 3-68).
STEP 2. REMOVE FLOOR PLATE COVERING MASTER CYLINDERS
STEP 3. REMOVE PLATE AS SHOWN ABOVE.
STEP 4. REMOVE PIN AND COTTER PIN AT INSIDE CONTROL MASTER CYLINDER CONNECTION.
STEP 5. DISCONNECT HYDRAULIC LINES AT TUBE NUTS AND IMMEDIATELY PLUG LINES.
STEP 6. REMOVE MOUNTING BOLTS, LOCKWASHERS AND NUTS, AND REMOVE MASTER CYLINDER.

ME 3810-288-12/3-71

Figure 3-71. Master cylinders, removal and replacement.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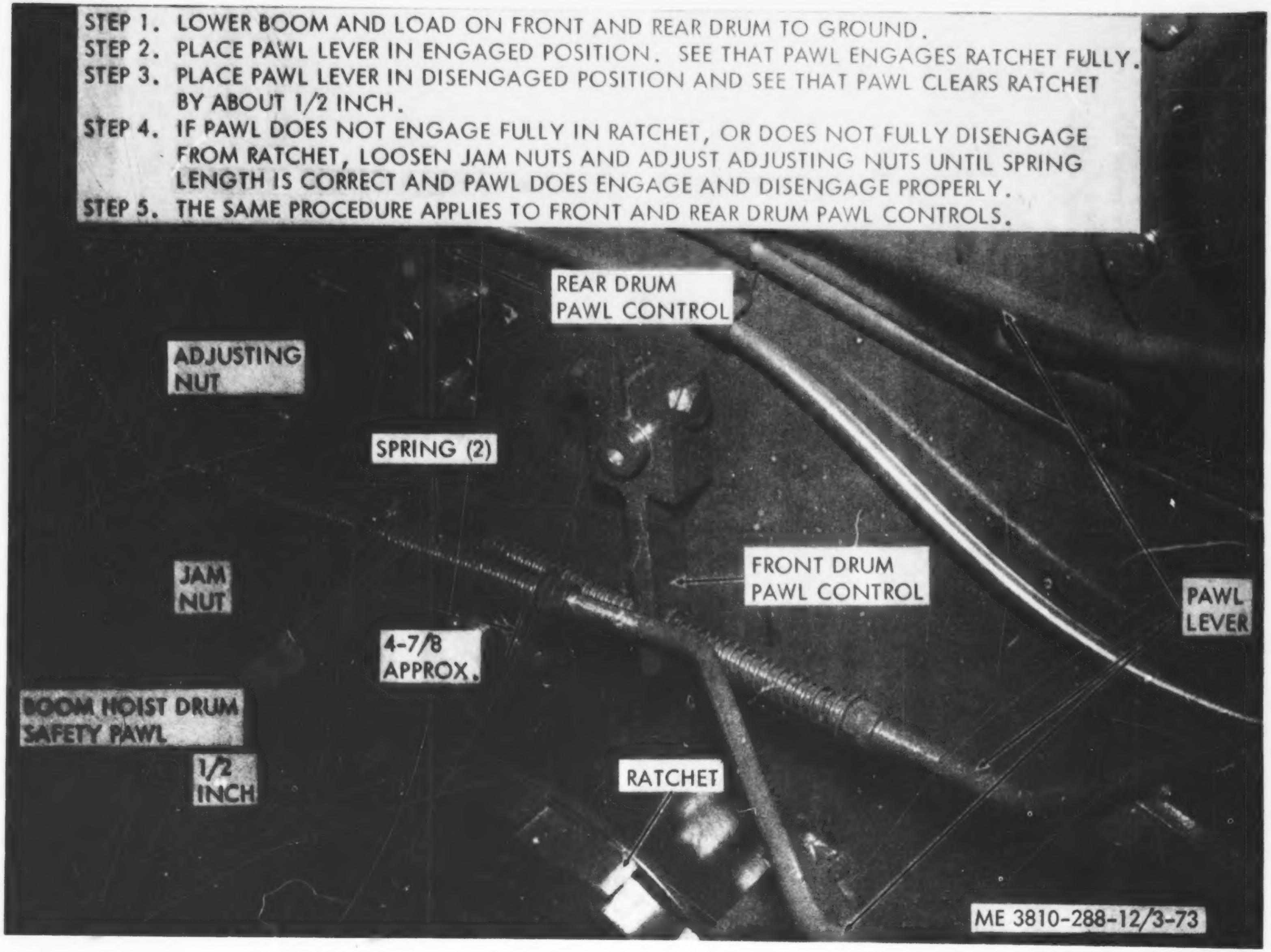
ME 3810-288-12/3-72

Figure 3-72. Control panel, repair, removal and replacement.

1. Switch, lights
2. Mounting bracket, gages
3. Bulb, gage illumination
4. Bulb socket, gage illumination
5. Switch, ignition
6. Mounting bracket, tachometer
7. Light, low oil pressure
8. Light, high water temperature
9. Switch, starter
10. Switch, heater
11. Nut
12. Washer, lock
13. Dash panel
14. Choke
15. Pump starting aid
16. Nameplates
17. Screw
18. Tachometer
19. Screw
20. Handle, ignition switch
21. Gage, water temperature
22. Gage, oil pressure
23. Gage, battery-generator
24. Gage, fuel
25. Hood, panel light
26. Bulb, panel illumination
27. Screw
28. Grommet
29. Screw
30. Washer, flat
31. Locknut, panel light

Figure 3–72. Control panel, repair, removal and replacement.



STEP 1. LOWER BOOM AND LOAD ON FRONT AND REAR DRUM TO GROUND.

STEP 2. PLACE PAWL LEVER IN ENGAGED POSITION. SEE THAT PAWL ENGAGES RATCHET FULLY.

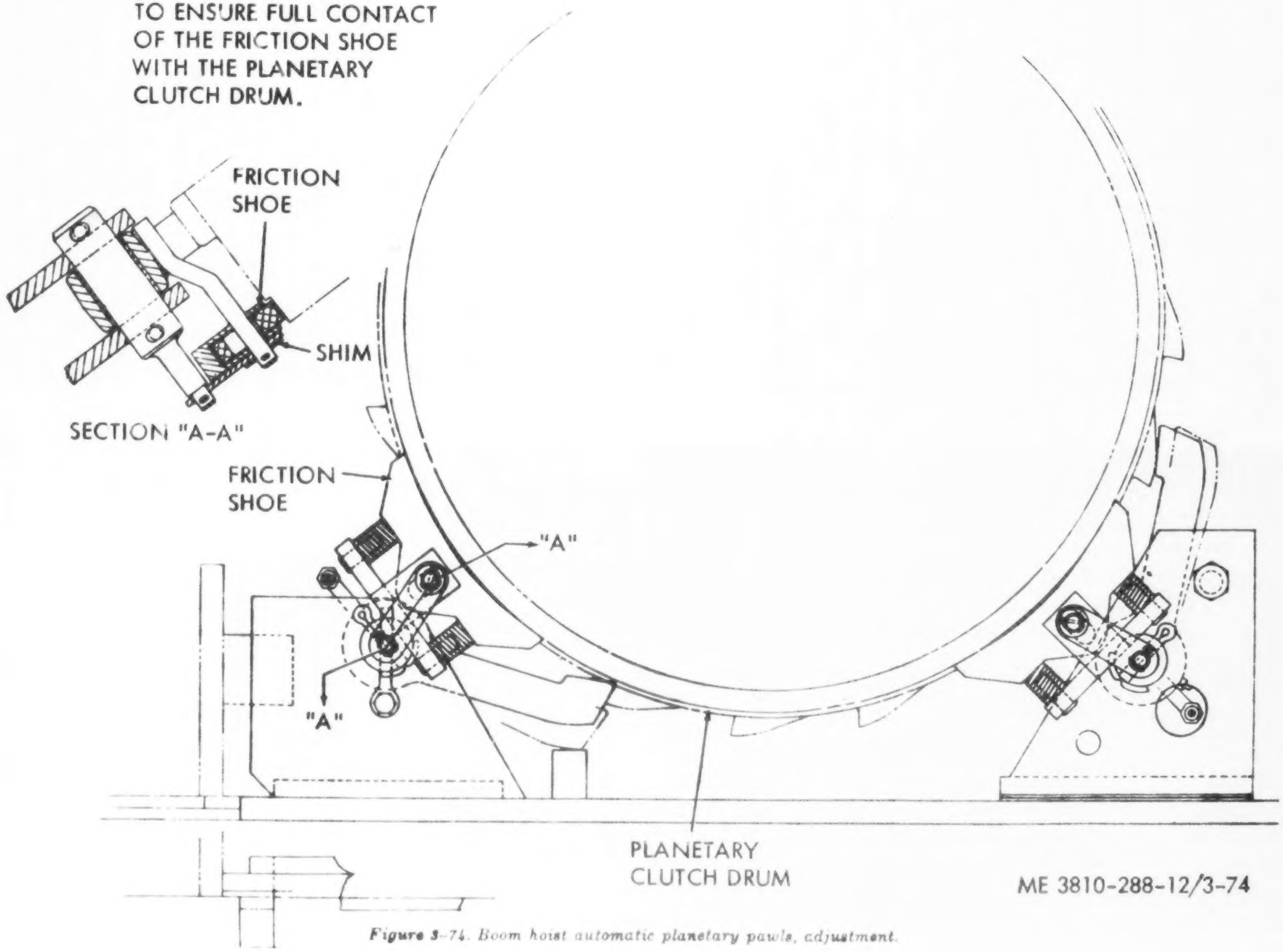
STEP 3. PLACE PAWL LEVER IN DISENGAGED POSITION AND SEE THAT PAWL CLEARS RATCHET BY ABOUT 1/2 INCH.

STEP 4. IF PAWL DOES NOT ENGAGE FULLY IN RATCHET, OR DOES NOT FULLY DISENGAGE FROM RATCHET, LOOSEN JAM NUTS AND ADJUST ADJUSTING NUTS UNTIL SPRING LENGTH IS CORRECT AND PAWL DOES ENGAGE AND DISENGAGE PROPERLY.

STEP 5. THE SAME PROCEDURE APPLIES TO FRONT AND REAR DRUM PAWL CONTROLS.

REAR DRUM PAWL CONTROL
ADJUSTING NUT
SPRING (2)
FRONT DRUM PAWL CONTROL
PAWL LEVER
JAM NUT
4-7/8 APPROX.
BOOM HOIST DRUM SAFETY PAWL
1/2 INCH
RATCHET
ME 3810-288-12/3-73

Figure 3-73. Boom hoist drum, rear drum, and front drum safety pawl adjustment.


FRICTION
SHOE
SHIM
SECTION "A-A"
FRICTION
SHOE
"A"
"A"
PLANETARY
CLUTCH DRUM

STEP 1. ADD SHIMS AS REQUIRED TO ENSURE FULL CONTACT OF THE FRICTION SHOE WITH THE PLANETARY CLUTCH DRUM.

ME 3810-288-12/3-74

Figure 3-74. Boom hoist automatic planetary pawls, adjustment.

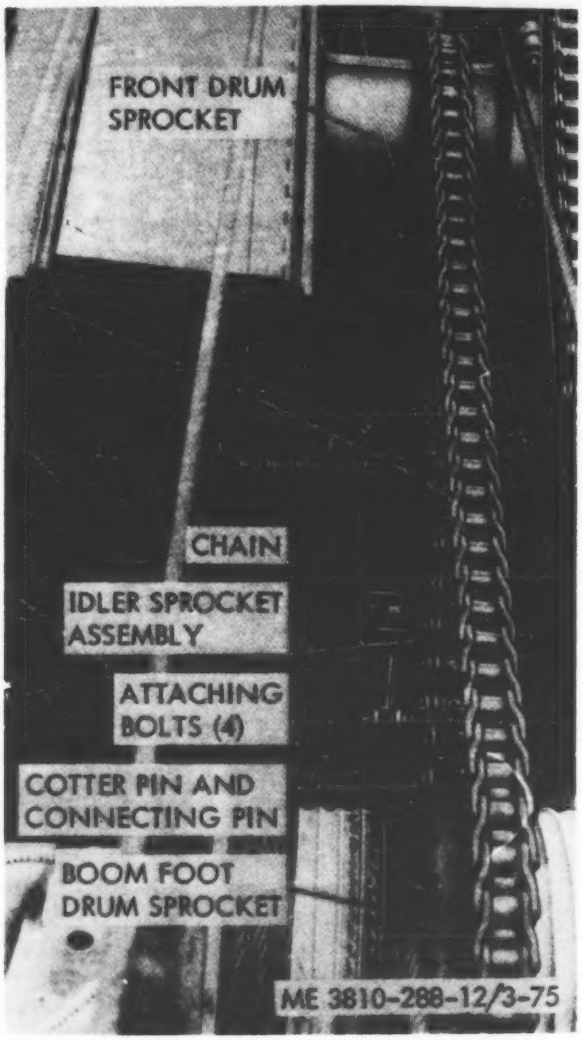


Figure 3-75. Crowd chain idler sprocket assembly, removal and replacement.

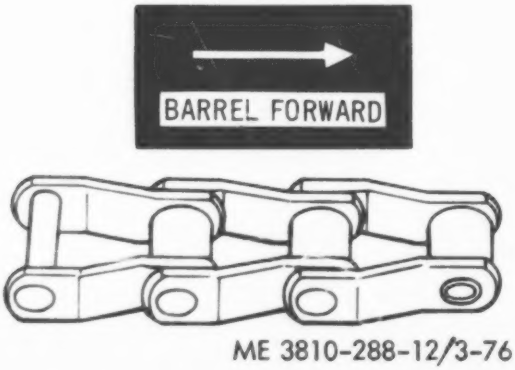


Figure 3-76. Crowd chain, direction of travel viewed from above while entering drive sprocket in crowd out direction.

(2) *Repair.* If a single section of otherwise unworn chain should break, refer to figure 3-77 and repair the chain by replacing the broken link.

e. Dipper Trip Electrical Wiring. Figure 3-78 is the wiring diagram for the dipper trip. When the shovel attachment is installed, the dipper trip pushbutton switch is mounted on a bracket on the front drum clutch lever in the same manner as the horn pushbutton is mounted on the swing lever. Refer to figure 2-36 for a view of the horn pushbutton, and remove or replace the dipper trip pushbutton switch. If closing the dipper trip pushbutton will not actuate the dipper trip mechanism, first check the batteries (para 3-49) to be sure they are in good condition and that cables are attached. Then, refer to figure 3-79 and replace the dipper trip motor magnetic switch.

f. Dipper Replacement. Refer to figure 3-80 and remove or replace the shovel dipper.

3-58. Crane, Dragline, and Clamshell Attachments

a. Boom. The boom for this machine is the same for crane, clamshell, or dragline operation. Refer to paragraph 2-5 and remove or install the crane boom.

b. Roller Guides. Roller guides are provided to assist in guiding the cable on the boom point sheaves and prevent friction contact with the boom. Refer to figure 3-81 and remove and replace cable guide rollers.

c. Tagline Winder.

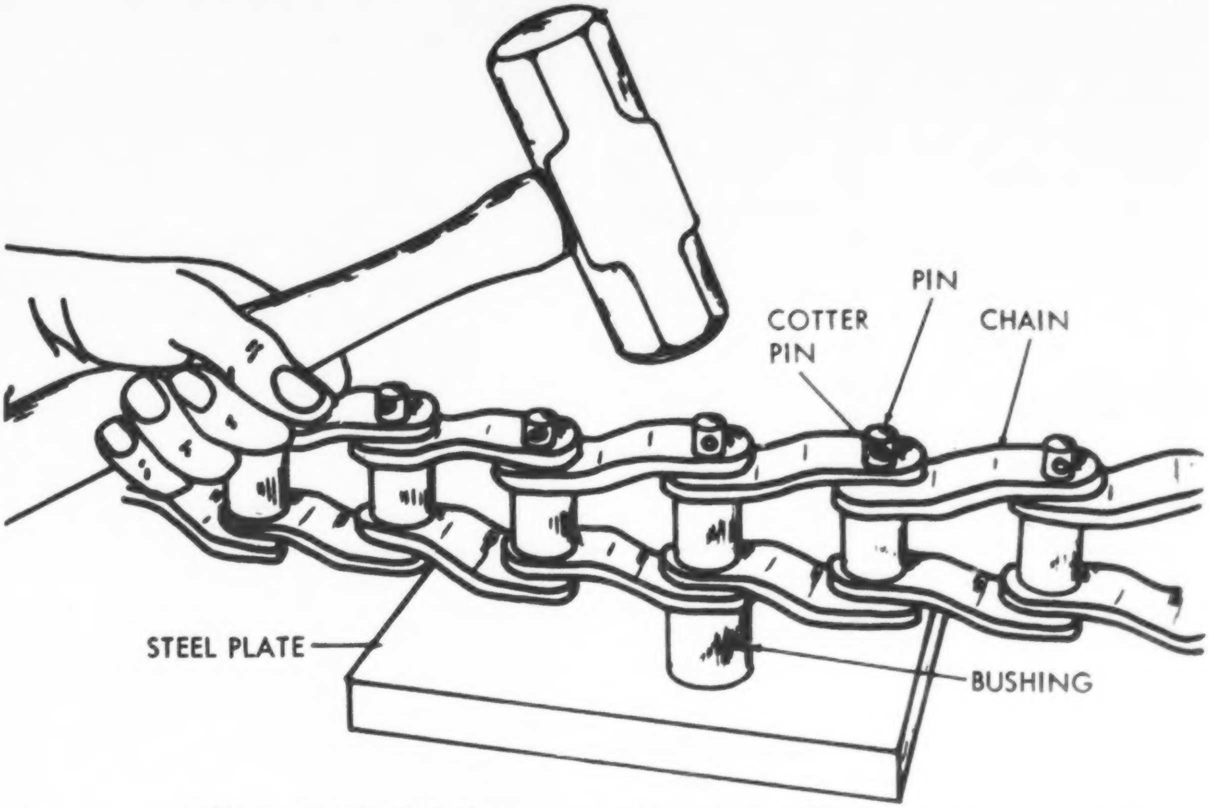
(1) *Removal.* Refer to paragraph 2-6 and remove the tagline winder.

(2) *Repair.* Drain oil from tagline winder by removing the pipe plug (48) on the end plate, figure 3-82. Refer to figure 3-82 and disassemble and repair the tagline winder. The most probable cause of trouble will be broken springs.

d. Upper Spreader. The upper spreader is sometimes called the bridle assembly.

(1) *Removal.* Refer to paragraph 2-5 and remove the upper spreader assembly.

(2) *Repair.* Refer to figure 3-83. Carefully inspect sheave bushings for signs of wear or damage and replace damaged bushings. Inspect sheaves for wear, grooving, or cracks, and replace worn or damaged sheaves. Inspect sheave pins for wear or scoring and smooth small rough points with a fine file or emery cloth. Replace severely



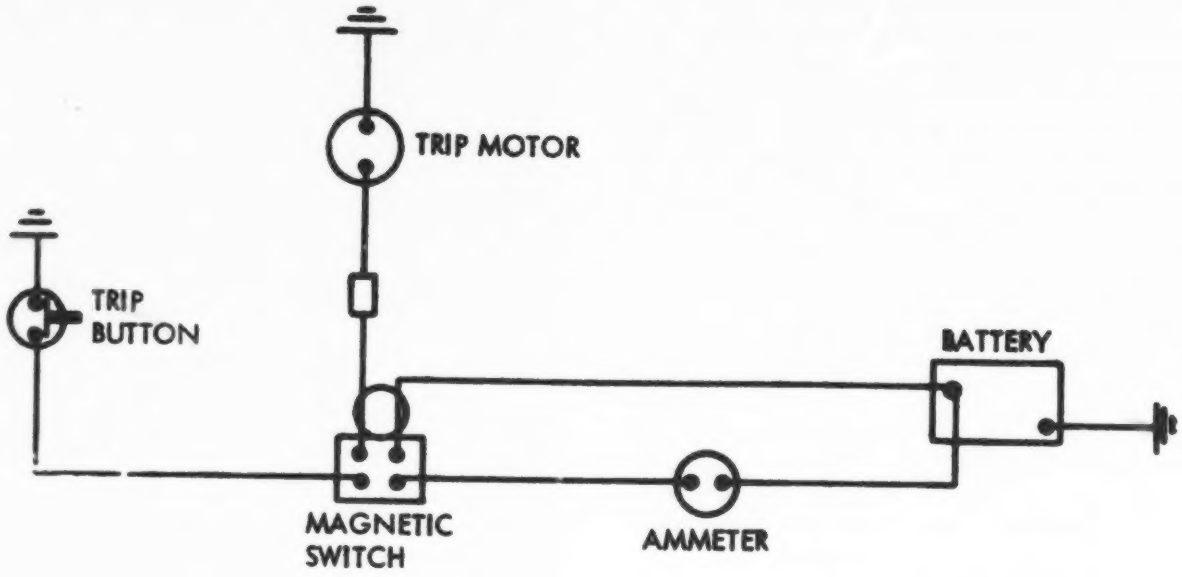
STEP 1. PLACE THE CHAIN ON STEEL PLATE WITH BUSHING BENEATH PIN. BUSHING MUST HAVE HOLE LARGER THAN PIN, AND MUST BE LONG ENOUGH TO ALLOW PIN TO MOVE.

STEP 2. STRIKE THE PIN VERY SHARPLY. HIT IT HARD. THIS WILL DRIVE THE PIN FROM THE CHAIN, WHILE CUTTING OFF COTTER PIN.

STEP 3. INSTALL NEW PIN AND DRIVE COTTER PIN IN PLACE. DO NOT FILE DOWN PINS TO AID IN INSTALLING. PRESS FITS ARE NEEDED FOR CHAIN LIFE.

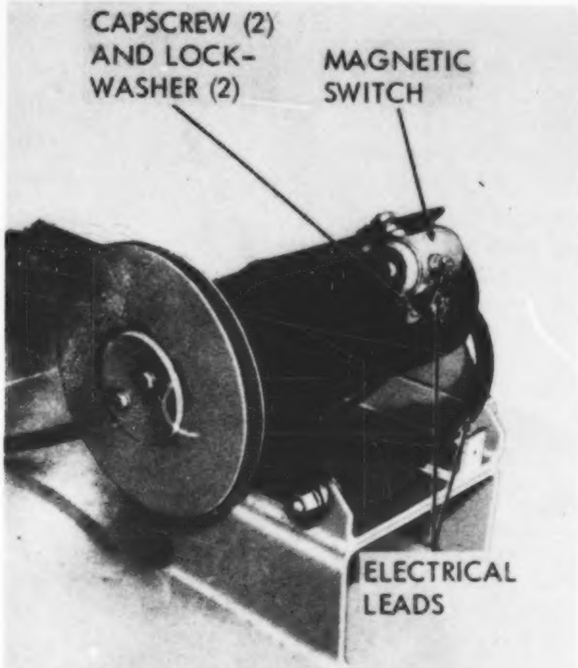
ME 3810-288-12/3-77

Figure 3-77. Chain, repair and replacement.


TRIP MOTOR
TRIP BUTTON
BATTERY
MAGNETIC SWITCH
AMMETER

ME 3810-288-12/3-78

Figure 3-78. Dipper trip wiring diagram.



STEP 1. DISCONNECT ELECTRICAL LEADS.
STEP 2. REMOVE CAPSCREWS AND LOCKWASHERS.
STEP 3. REMOVE MAGNETIC SWITCH.

ME 3810-288-12/3-79

Figure 3-79. Dipper trip magnetic switch, removal and replacement.

worn or scored pins. Clean sheaves with a proper solvent, removing all old lubricant. Inspect lubrication fittings and make sure that passages are open and have been receiving the lubricant.

Note. A properly grooved sheave has smooth side walls and the groove is only slightly wider than the cable. Use a light layer of lubricant when reinstalling pins, bushings, and other fitted parts. Be sure lubrication fittings are properly installed and line up with grease holes.

(3) *Replacement.* Refer to paragraph 2-5 and replace the upper spreader assembly.

e. Clamshell and Dragline Buckets. When teeth are worn to about one third of their original length, drive out the attaching pins and replace dipper teeth. Replace dump cable when it is frayed or worn. Replace sheave bushings and sheaves as described under paragraph 3-58*d*.

f. Boom Point Sheaves. Refer to figure 3-84 and remove and replace boom point sheaves.

g. Jib Strut. The jib strut is also called the jib boom mast. Inspect for cracks or signs of damage, paying particular attention to possible cracks at the welded joints of the strut lacings. Report any sign of faulty welds or damage to proper authority. Sheaves and sheave bushings must be inspected for signs of wear or damage as described in paragraph 3-58d and repaired or replaced as necessary.

h. Boom Backstops.

(1) *Removal.* Refer to paragraph 2-5 and remove boom backstops.

(2) *Repair.* Refer to figure 3-85 and remove inner telescoping members from the backstops. Inspect springs for permanent set, cracks, or other damage, and replace faulty springs. Clean all old lubricant from the inner telescoping members and replace faulty pins. Lubricate in accordance with the lubrication order before returning the machine to service.

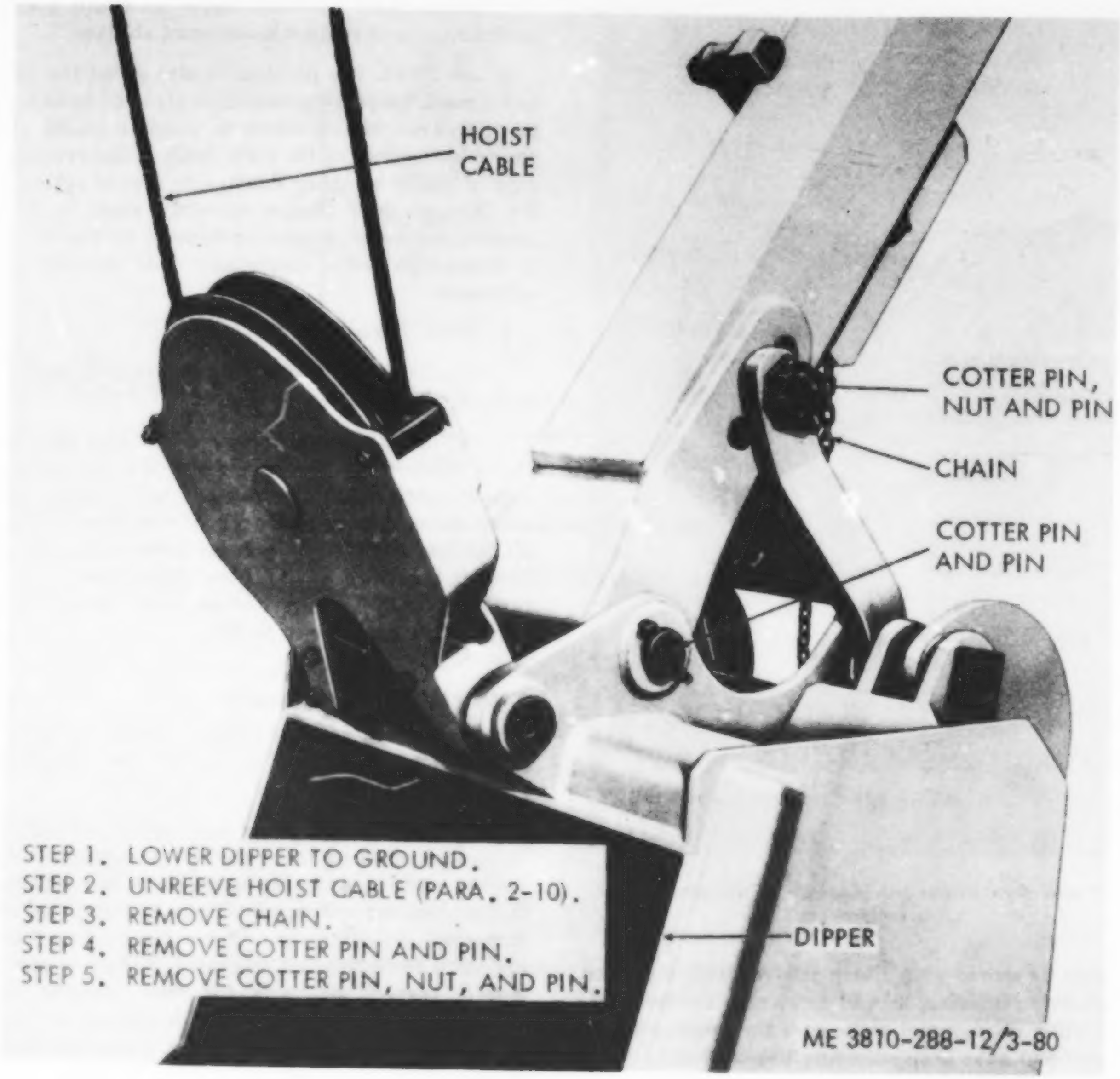
3-59. Backhoe Attachment

a. Removal and Installation. Refer to paragraph 2-9 and remove or install the complete backhoe attachment.

b. Repair. Inspect cables and replace frayed or damaged cables as instructed in paragraph 2-9. Inspect sheaves and sheave bushings and replace faulty sheaves or sheave bushings as instructed in paragraph 3-58d, replace dipper teeth when they are worn down to about one third of their original length. Inspect all parts for wear, defects, or damage of any type, and repair or replace any defective parts. Replace side cutters if they are dull or broken.

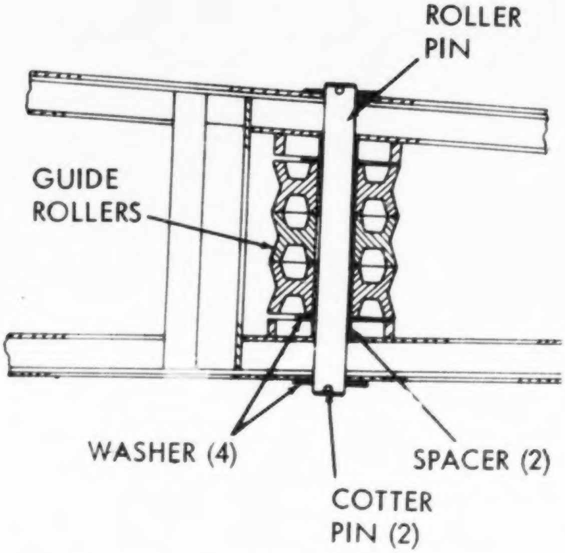
3-60. Piledriver Attachment

Repair of the piledriver attachment consists of periodic inspection for faulty welds, bent lacings, or other damage to structural members. Any damaged item which affects structural strength must be reported to proper authority. Lubricate the piledriver leads as described in the lubrication order. Run the hammer up and down a few times while lubricating and apply more lubricant until hammer leads and guides are well lubricated. Keep the piledriver structure clean, well painted to prevent corrosion, and machined surfaces free


HOIST CABLE
COTTER PIN, NUT AND PIN
CHAIN
COTTER PIN AND PIN
DIPPER
ME 3810-288-12/3-80

STEP 1. LOWER DIPPER TO GROUND.
STEP 2. UNREEVE HOIST CABLE (PARA. 2-10).
STEP 3. REMOVE CHAIN.
STEP 4. REMOVE COTTER PIN AND PIN.
STEP 5. REMOVE COTTER PIN, NUT, AND PIN.

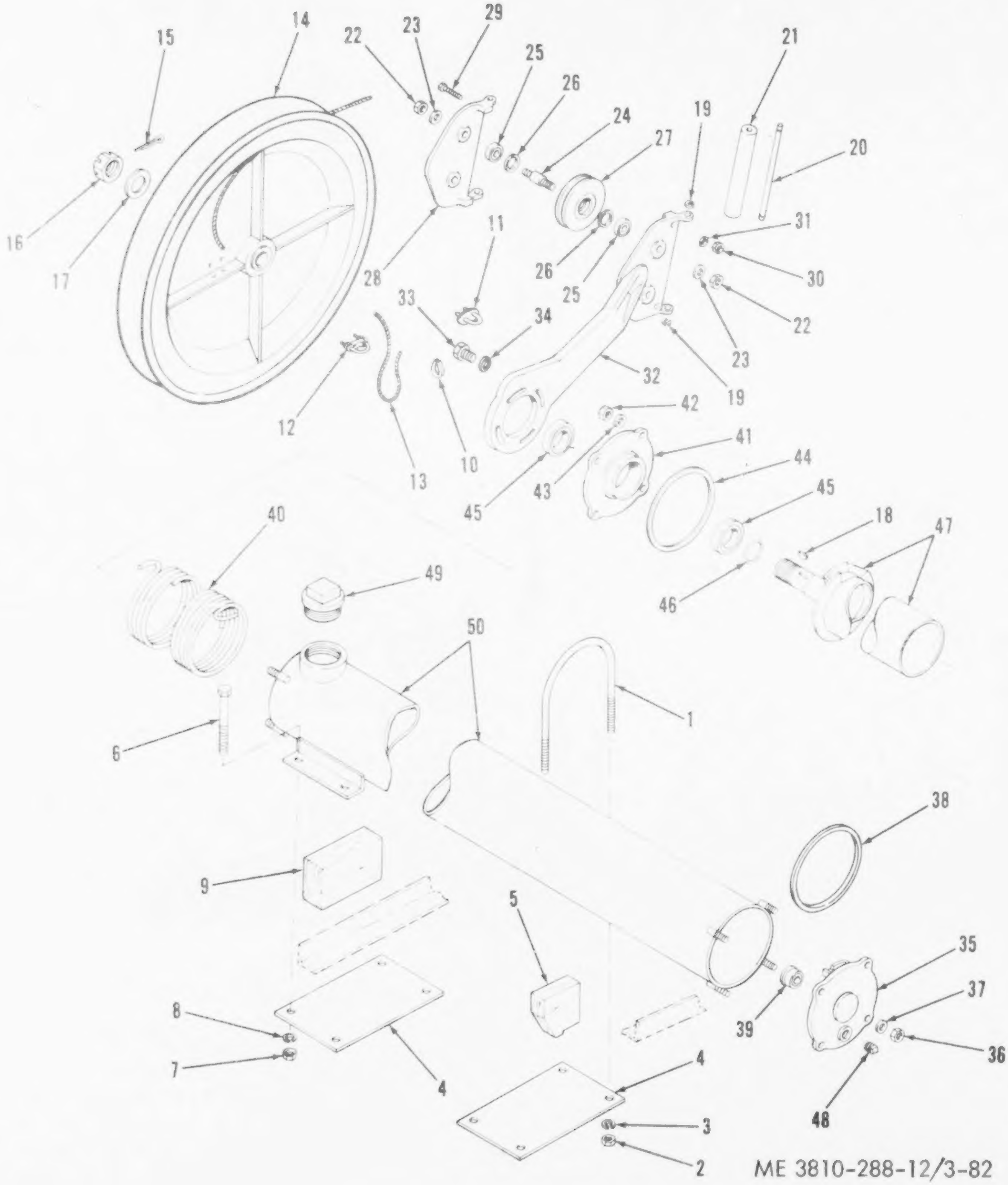
Figure 3-80. Shovel dipper, removal and installation.


ROLLER
PIN
GUIDE
ROLLERS
WASHER (4)
SPACER (2)
COTTER
PIN (2)

STEP 1. REMOVE COTTER PIN AT EITHER END.
STEP 2. REMOVE EXTERNAL WASHER AT END COTTER PIN WAS REMOVED.
STEP 3. PRESS ROLLER PIN OUT FROM END COTTER PIN WAS REMOVED. REMOVE SPACERS AND GUIDE ROLLERS.

ME 3810-288-12/3-81

Figure 3-81. Cable guide rollers, removal and replacement.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3
48
2
ME 3810-288-12/3-82

Figure 3-82. Tagline Winder, repair.

1. U-bolt
2. Hex nut
3. Lock washer
4. Plate
5. Wood fill block
6. Capscrew
7. Hex nut
8. Lock washer
9. Wood fill block
10. Rope thimble
11. Clamp
12. Clamp
13. Wire rope
14. Cable drum
15. Cotter pin
16. Slotted nut
17. Flat washer
18. Woodruff key
19. Retaining ring
20. Roller shaft
21. Front roller
22. Hex nut
23. Lock washer
24. Pulley shaft
25. Ball bearing
26. Spacing ring
27. Groove pulley
28. Guide frame
29. Capscrew
30. Hex nut
31. Lock washer
32. Guide arm
33. Capscrew
34. Washer
35. End plate
36. Hex nut
37. Lock washer
38. Plate gasket
39. Ball bearing
40. Helix torsion spring
41. End plate
42. Hex nut
43. Lock washer
44. Plate gasket
45. Ball bearing
46. Preformed packing
47. Spring guide
48. Pipe plug
49. Pipe plug
50. Housing

Figure 3-82. Tagline Winder, repair.

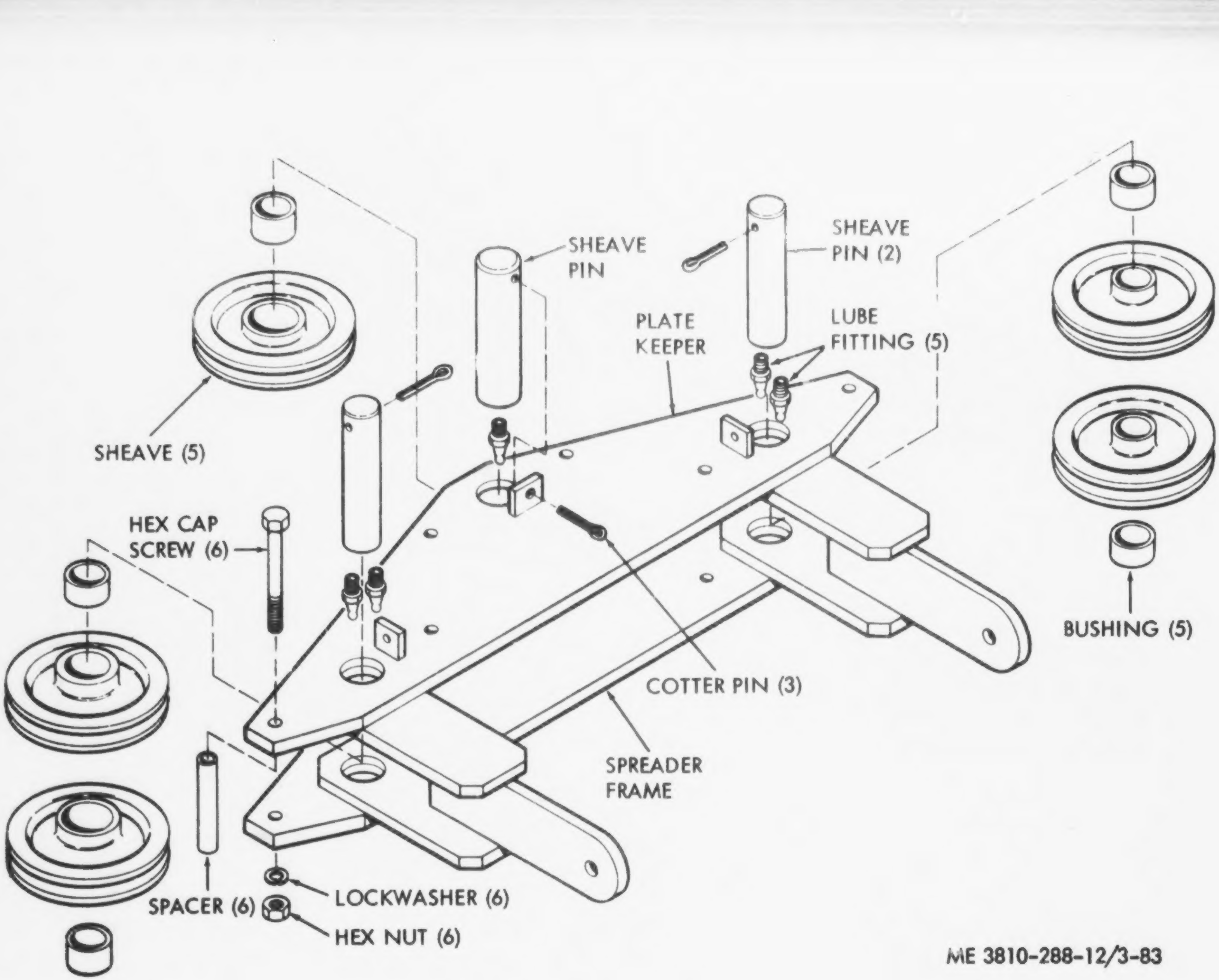
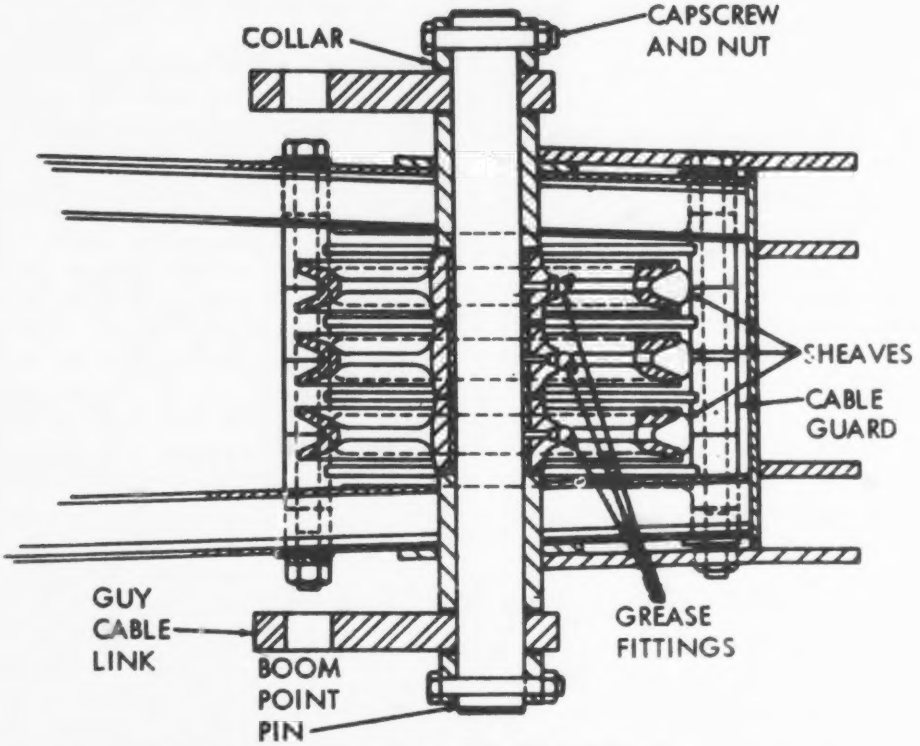

SHEAVE PIN
SHEAVE PIN (2)
PLATE KEEPER
LUBE FITTING (5)
SHEAVE (5)
HEX CAP SCREW (6)
COTTER PIN (3)
BUSHING (5)
SPREADER FRAME
LOCKWASHER (6)
SPACER (6)
HEX NUT (6)
ME 3810-288-12/3-83

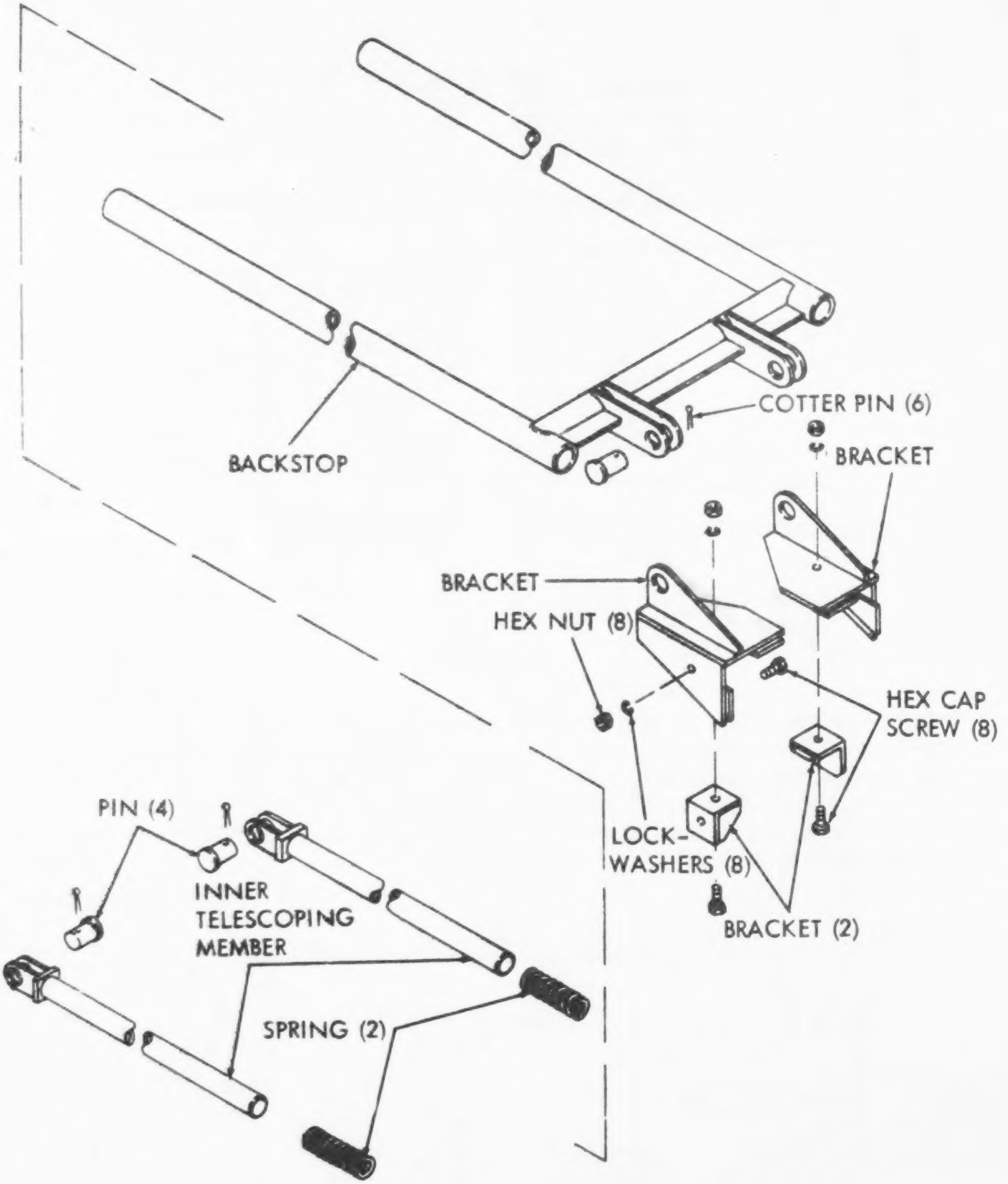
Figure 3–83. Upper spreader, repair and replacement.


COLLAR
CAPSCREW AND NUT
SHEAVES
CABLE GUARD
GUY CABLE LINK
BOOM POINT PIN
GREASE FITTINGS

STEP 1. LOWER BOOM TO REST ON ADEQUATE SUPPORT.
STEP 2. REMOVE CAPSCREW, NUT, AND COLLAR ON EACH SIDE.
STEP 3. REMOVE GUY CABLE LINK.
STEP 4. SUPPORT SHEAVES SO THEY CAN NOT FALL.
STEP 5. USE WOODEN BLOCK AND HAMMER AND DRIVE BOOM POINT PIN OUT.
STEP 6. REMOVE SHEAVES.

ME 3810-288-12/3-84

Figure 3-84. Boom point sheaves, removal and replacement.


COTTER PIN (6)
BRACKET
BACKSTOP
BRACKET
HEX NUT (8)
HEX CAP SCREW (8)
PIN (4)
LOCK-WASHERS (8)
INNER TELESCOPING MEMBER
BRACKET (2)
SPRING (2)

ME 3810-288-12/3-85

Figure 3-85. Boom backstops, repair and replacement.

of corrosion. Refer to paragraph 2–8 for information concerning installation or removal of the piledriver attachment.

3–61. Clutch and Brake Band Removal and Replacement

In every case where clutches or brake bands are to be removed or replaced, safety requires that the load being supported by that clutch or brake be lowered to the ground. Specifically, always lower the boom to the ground before working on the boom hoist brake or clutch. Lower the loads to the ground before working on front or rear drum brake or clutches. Secure the revolving frame from turning before working on swing brake, swing brake lock, or anti-rotation device. Always lower attachments, including shovel fronts, backhoe fronts, clamshell and dragline buckets, booms and jibs, and piledriver or magnets to the ground or to proper supports to prevent any possible injury to personnel or damage to the machine.

3–62. Rear Drumshaft Brake and Clutch

a. General. Always adjust a brake or clutch which has been removed before returning the machine to operation.

b. Brake Band. Refer to figure 3–86 and remove or replace the rear drum brake band.

c. Clutch Band. Refer to figure 3–87 and remove or replace the rear drumshaft clutch band. Position the clutch band as required by "tapping" the engine start pushbutton.

3–63. Front Drumshaft Brake and Clutch

The front drumshaft brake bands and clutch bands are removed and replaced in the same manner as the rear drumshaft brake and clutch bands. The only difference is that the front drumshaft clutches and brakes are assembled reversed, since the drumshafts turn in opposite directions. Refer to figures 3–86 and 3–87 and remove front umshaft brake and clutch bands.

64. Reversing Shaft and Horizontal Swing Shaft Clutch

The reversing shaft clutch and the two horizontal swing shaft clutches are all identical in appearance and in removal and replacement procedures. Refer to figure 3–88 and remove or replace a reversing shaft or horizontal swing shaft clutch as shown.

3–65. Boom Hoist Shaft Brake and Clutch

a. Brake Band Removal. The boom hoist brake band is removed as an assembly. Refer to figures 3–13 and 3–90 for views showing the band assembled. In order to remove the brake band assembly, remove items 1 through 7 of figure 3–89. The entire assembly can then be removed to the bench for complete disassembly as shown. Unscrew the threaded end of the lower brake band from the adjusting rod to complete removal of the brake bands. Note that the phantomed pin on figure 3–89 is welded to the revolving frame side frame and can not be removed.

b. Refer to figure 3–90 and remove or replace the boom hoist shaft clutch. Always place the boom on suitable supports before working on the clutch.

3–66. Swing Brake

Refer to figure 3–91 and remove or replace swing brake shoes. Engage the swing brake lock, figure 2–36, to prevent the upper from turning.

3–67. Drive Chains

a. General. The removal and replacement procedures for each drive chain will be given below.

b. Reversing Shaft Chain. Refer to figure 3–92 and remove the reversing shaft chain.

c. Rear Drum Chain. Refer to figure 3–93 and remove the rear drum chain case. Then refer to figure 3–94 and remove the rear drum chain.

d. Horizontal Swing Shaft Chain. Refer to figure 3–95 and remove the horizontal swing shaft chains.

e. Shovel Crowd Chain. Removal and replacement procedures for the shovel crowd chain are covered in paragraph 3–57.

3–68. Hook Rollers

a. Removal. Refer to figure 3–96 and remove hook rollers. There is a single hook roller at the front of the revolving frame as shown in figure 3–96. A double hook roller of identical design is used at the rear of the revolving frame. Removal and replacement are the same.

b. Adjustment. Refer to figure 3–97 and adjust hook rollers if clearance between rollers and roller path exceeds 1/16 inch. Items shown in figure 3–96 are also identified on figure 3–97 for clear understanding.

STEP 1. LOWER LOAD ON FRONT OR REAR DRUM LINE TO GROUND.

STEP 2. REMOVE ADJUSTING NUT AND ADJUSTING BOLT.

STEP 3. REMOVE COTTER PIN AND UPPER BRAKE BAND PIN. THESE PINS ARE REACHED FROM BEHIND REAR DRUM. REMOVE UPPER BRAKE BAND.

STEP 4. REFER TO FIGURE 3-70 AND REMOVE LOWER BRAKE BAND COTTER PIN AND PIN THROUGH HAND HOLE.

STEP 5. REMOVE SPRING ADJUSTING NUT AND JAM NUT. SLIDE LOWER BRAKE BAND AROUND DRUM AND REMOVE LOWER BRAKE BAND.

STEP 6. REMOVE FRONT DRUM BRAKE BAND IN SAME MANNER.

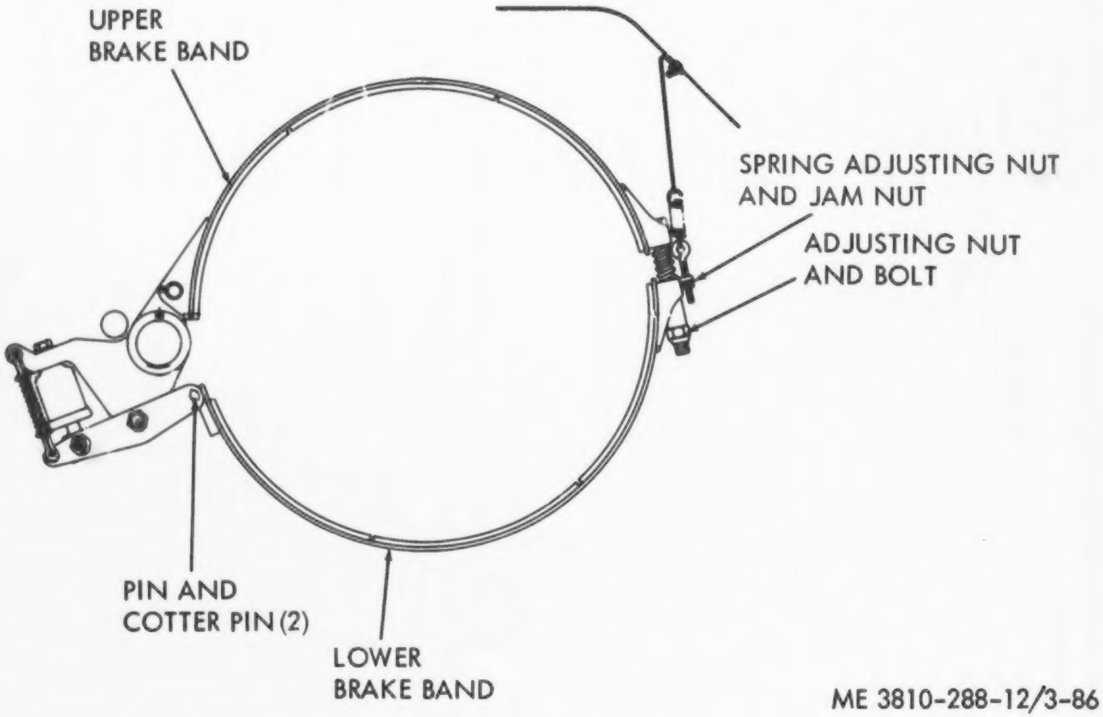
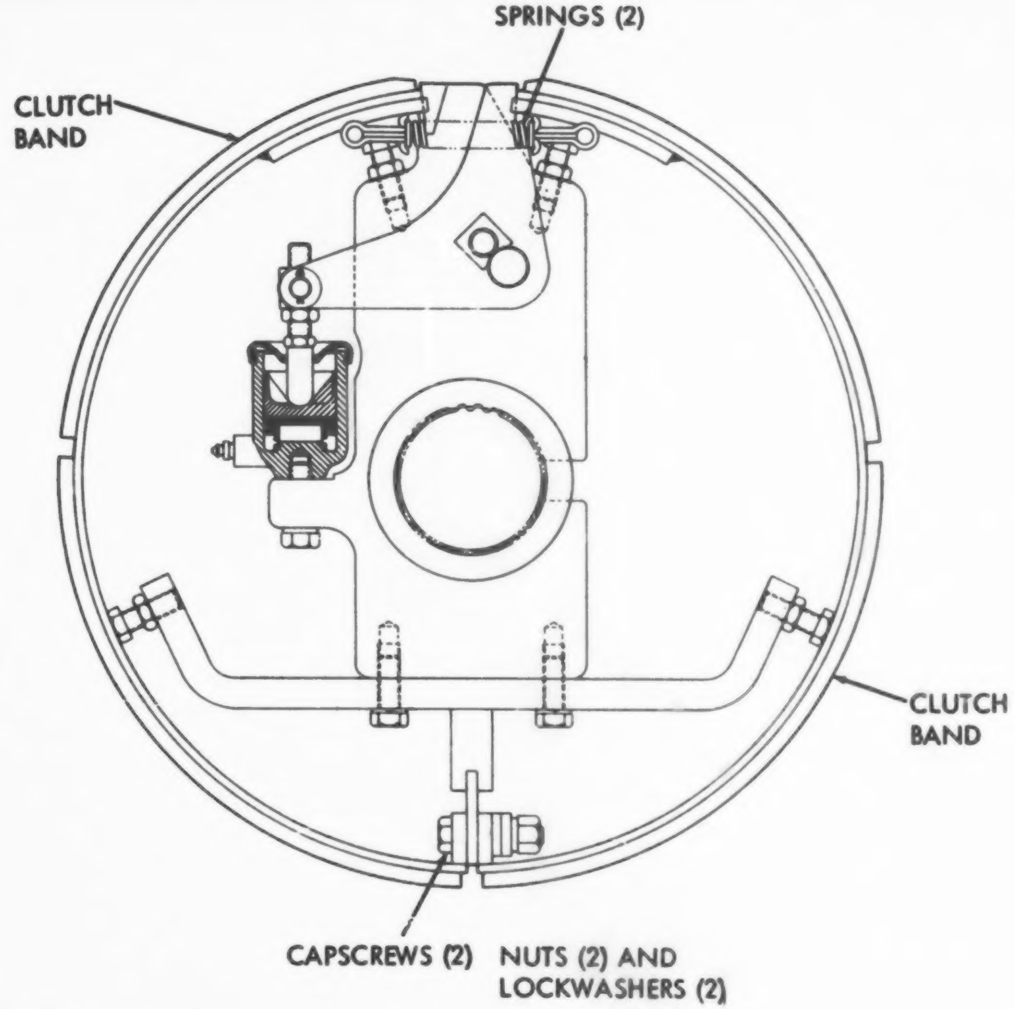

UPPER BRAKE BAND
SPRING ADJUSTING NUT AND JAM NUT
ADJUSTING NUT AND BOLT
PIN AND COTTER PIN (2)
LOWER BRAKE BAND
ME 3810-288-12/3-86

Figure 3-86. Rear drumshaft brake band, removal and replacement.


SPRINGS (2)
CLUTCH BAND
CLUTCH BAND
CAPSCREWS (2)
NUTS (2) AND LOCKWASHERS (2)

STEP 1. LOWER LOAD TO GROUND.

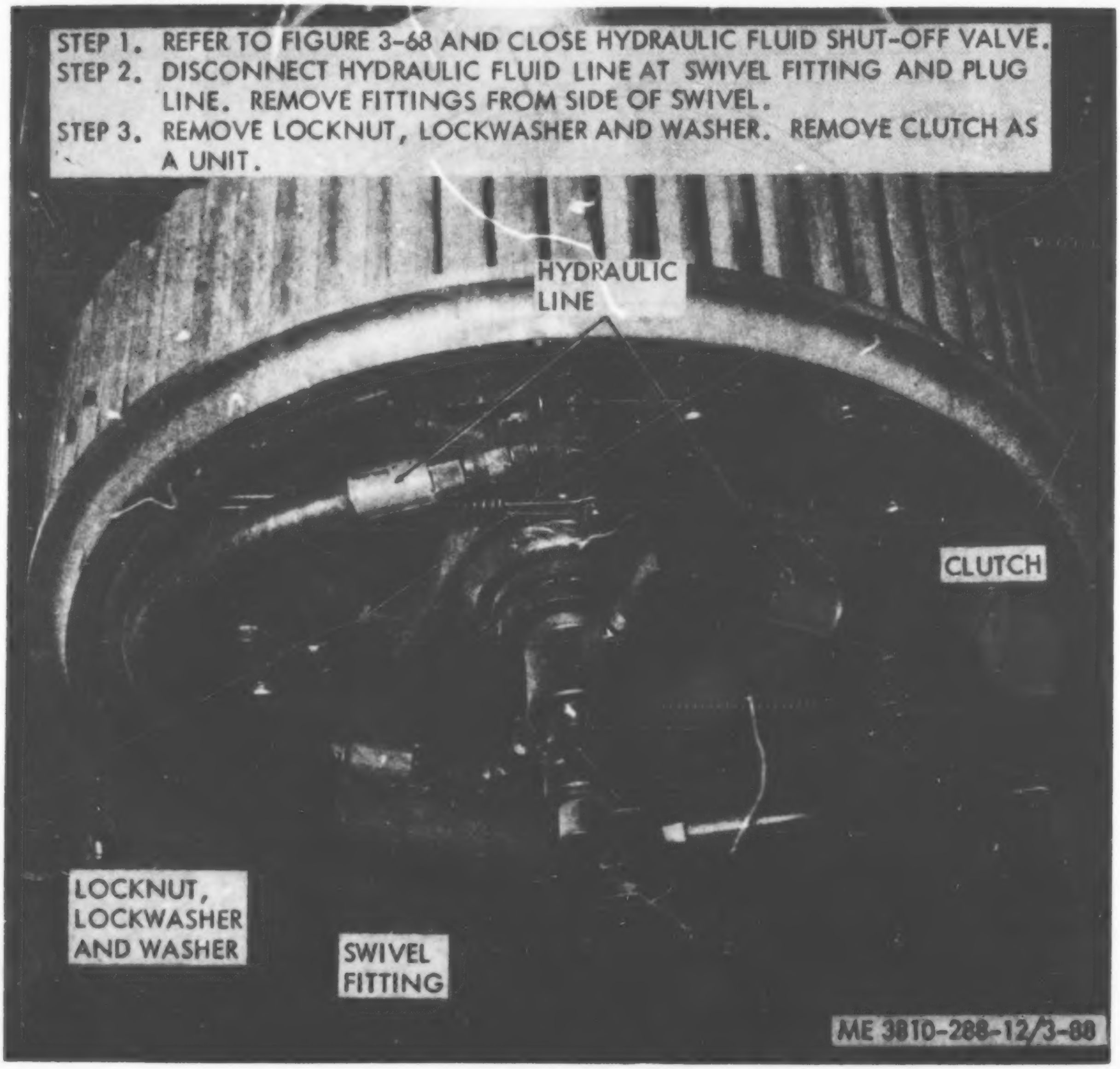
STEP 2. BE SURE IGNITION SWITCH IS IN OFF POSITION. REMOVE SPRINGS.

STEP 3. USE ENGINE START PUSHBUTTON TO POSITION CLUTCH BAND WITH BAND SPLIT CAPSCREWS JUST ABOVE SIDEBAND. REMOVE CAPSCREWS AND SPLIT BAND.

STEP 4. REMOVE UPPER CLUTCH BAND.

STEP 5. TAP ENGINE START PUSHBUTTON TO POSITION OTHER CLUTCH BAND ON TOP. REMOVE OPPOSITE CLUTCH BAND.

ME 3810-288-12/3-87



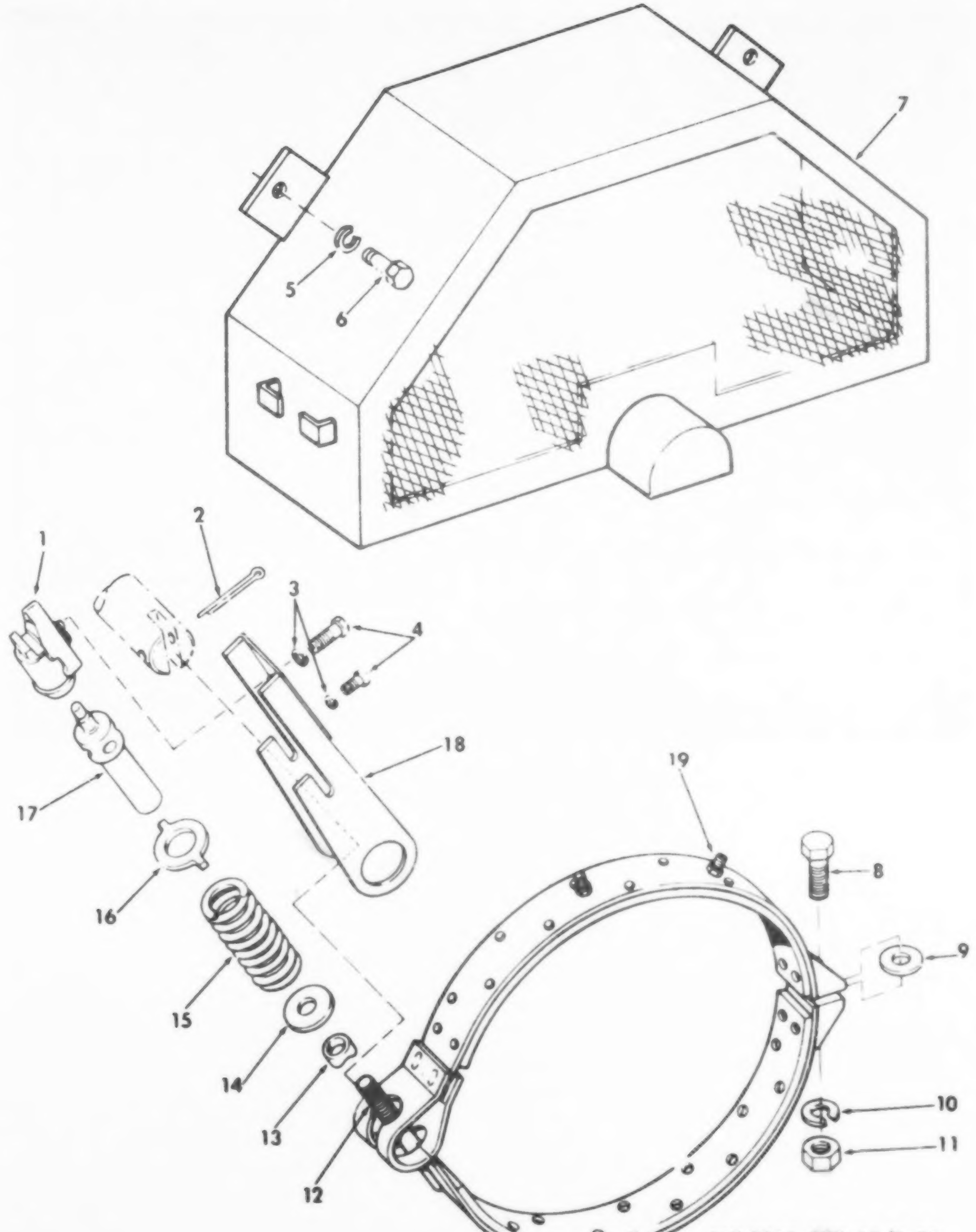
STEP 1. REFER TO FIGURE 3-68 AND CLOSE HYDRAULIC FLUID SHUT-OFF VALVE.

STEP 2. DISCONNECT HYDRAULIC FLUID LINE AT SWIVEL FITTING AND PLUG LINE. REMOVE FITTINGS FROM SIDE OF SWIVEL.

STEP 3. REMOVE LOCKNUT, LOCKWASHER AND WASHER. REMOVE CLUTCH AS A UNIT.

HYDRAULIC LINE
CLUTCH
LOCKNUT, LOCKWASHER AND WASHER
SWIVEL FITTING
ME 3810-288-12/3-88

Figure 3-88. Reversing shaft or horizontal swing shaft clutch, removal or replacement.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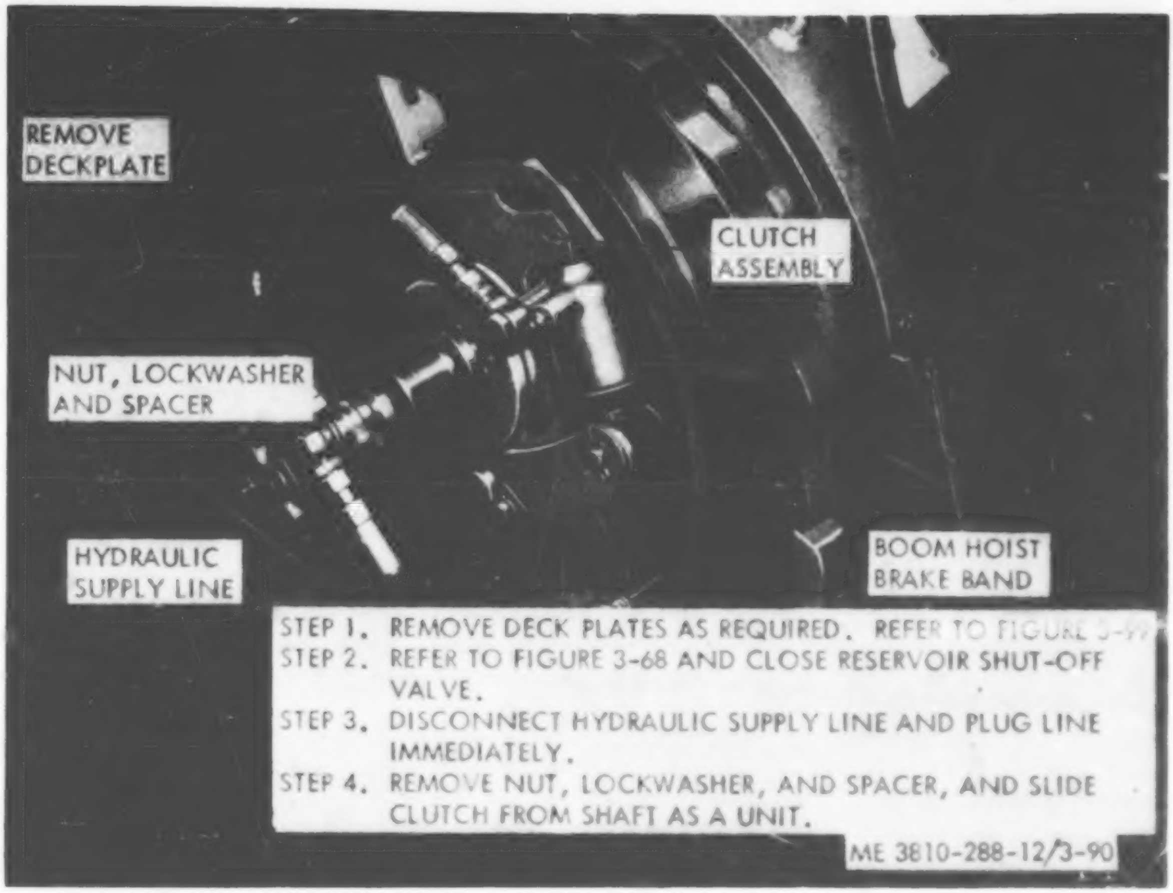
ME 3810-288-12/3-89

Figure 3-89. Boom hoist brake band, removal or replacement.

1. Brake cylinder
2. Pin, cotter
3. Lockwasher
4. Capscrew
5. Lockwasher
6. Screw
7. Guard
8. Capscrew
9. Washer, flat
10. Lockwasher
11. Nut
12. Rod, threaded
13. Spacer
14. Washer, flat
15. Spring
16. Washer, brake
17. Push rod
18. Bracket
19. Brake band assembly

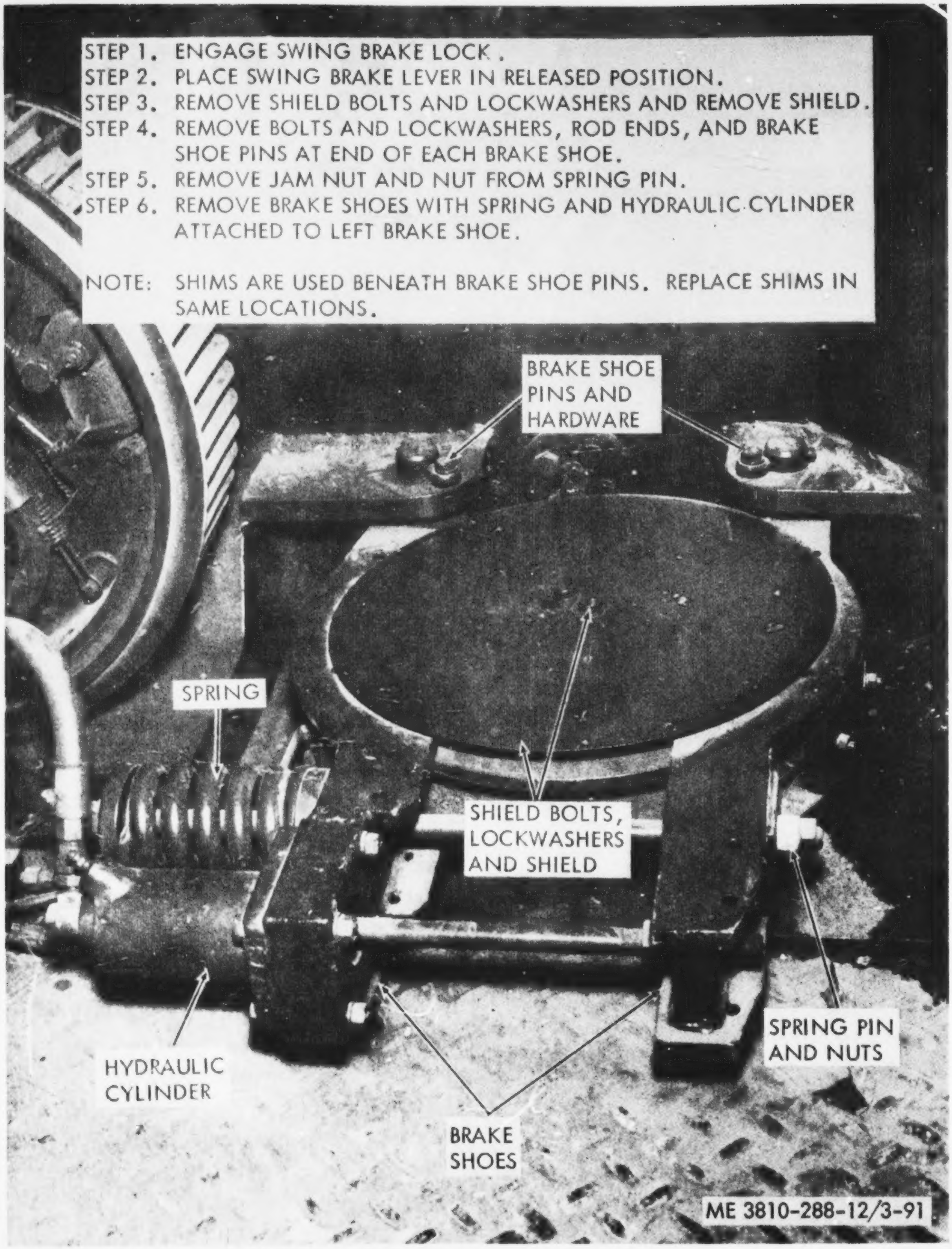
Figure 3-89. Boom hoist brake band, removal or replacement.


REMOVE DECKPLATE
CLUTCH ASSEMBLY
NUT, LOCKWASHER AND SPACER
HYDRAULIC SUPPLY LINE
BOOM HOIST BRAKE BAND

STEP 1. REMOVE DECK PLATES AS REQUIRED. REFER TO FIGURE 3-99
STEP 2. REFER TO FIGURE 3-68 AND CLOSE RESERVOIR SHUT-OFF VALVE.
STEP 3. DISCONNECT HYDRAULIC SUPPLY LINE AND PLUG LINE IMMEDIATELY.
STEP 4. REMOVE NUT, LOCKWASHER, AND SPACER, AND SLIDE CLUTCH FROM SHAFT AS A UNIT.

ME 3810-288-12/3-90

Figure 3-90. Boom hoist clutch, removal or replacement.



STEP 1. ENGAGE SWING BRAKE LOCK.
STEP 2. PLACE SWING BRAKE LEVER IN RELEASED POSITION.
STEP 3. REMOVE SHIELD BOLTS AND LOCKWASHERS AND REMOVE SHIELD.
STEP 4. REMOVE BOLTS AND LOCKWASHERS, ROD ENDS, AND BRAKE SHOE PINS AT END OF EACH BRAKE SHOE.
STEP 5. REMOVE JAM NUT AND NUT FROM SPRING PIN.
STEP 6. REMOVE BRAKE SHOES WITH SPRING AND HYDRAULIC CYLINDER ATTACHED TO LEFT BRAKE SHOE.

NOTE: SHIMS ARE USED BENEATH BRAKE SHOE PINS. REPLACE SHIMS IN SAME LOCATIONS.

BRAKE SHOE PINS AND HARDWARE
SPRING
SHIELD BOLTS, LOCKWASHERS AND SHIELD
HYDRAULIC CYLINDER
SPRING PIN AND NUTS
BRAKE SHOES
ME 3810-288-12/3-91

Figure 3-91. Swing brake shoes, removal and replacement.

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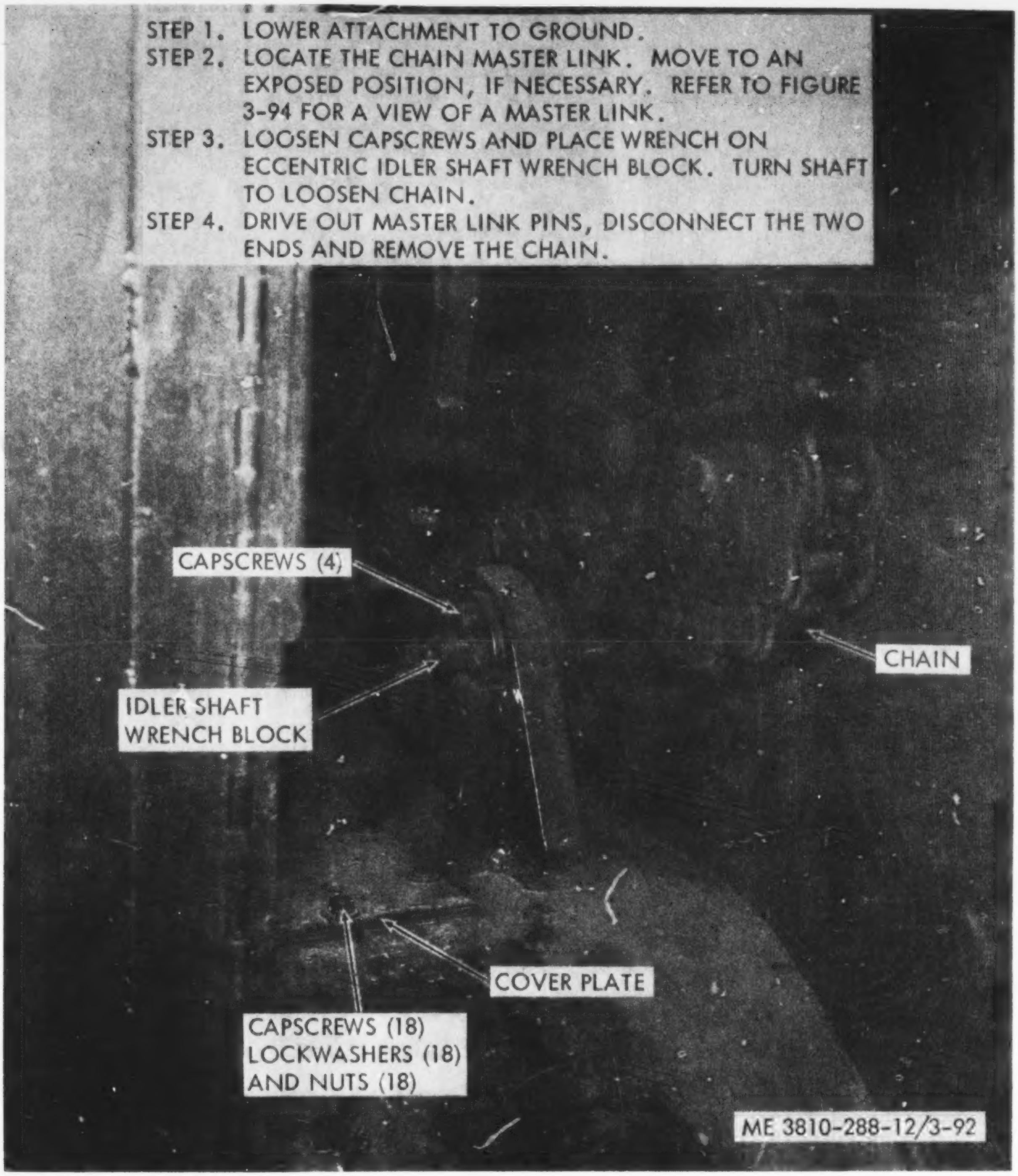


STEP 1. LOWER ATTACHMENT TO GROUND.

STEP 2. LOCATE THE CHAIN MASTER LINK. MOVE TO AN EXPOSED POSITION, IF NECESSARY. REFER TO FIGURE 3-94 FOR A VIEW OF A MASTER LINK.

STEP 3. LOOSEN CAPSCREWS AND PLACE WRENCH ON ECCENTRIC IDLER SHAFT WRENCH BLOCK. TURN SHAFT TO LOOSEN CHAIN.

STEP 4. DRIVE OUT MASTER LINK PINS, DISCONNECT THE TWO ENDS AND REMOVE THE CHAIN.

CAPSCREWS (4)
CHAIN
IDLER SHAFT WRENCH BLOCK
COVER PLATE
CAPSCREWS (18) LOCKWASHERS (18) AND NUTS (18)
ME 3810-288-12/3-92

Figure 3-92. Reversing shaft chain, removal and replacement.

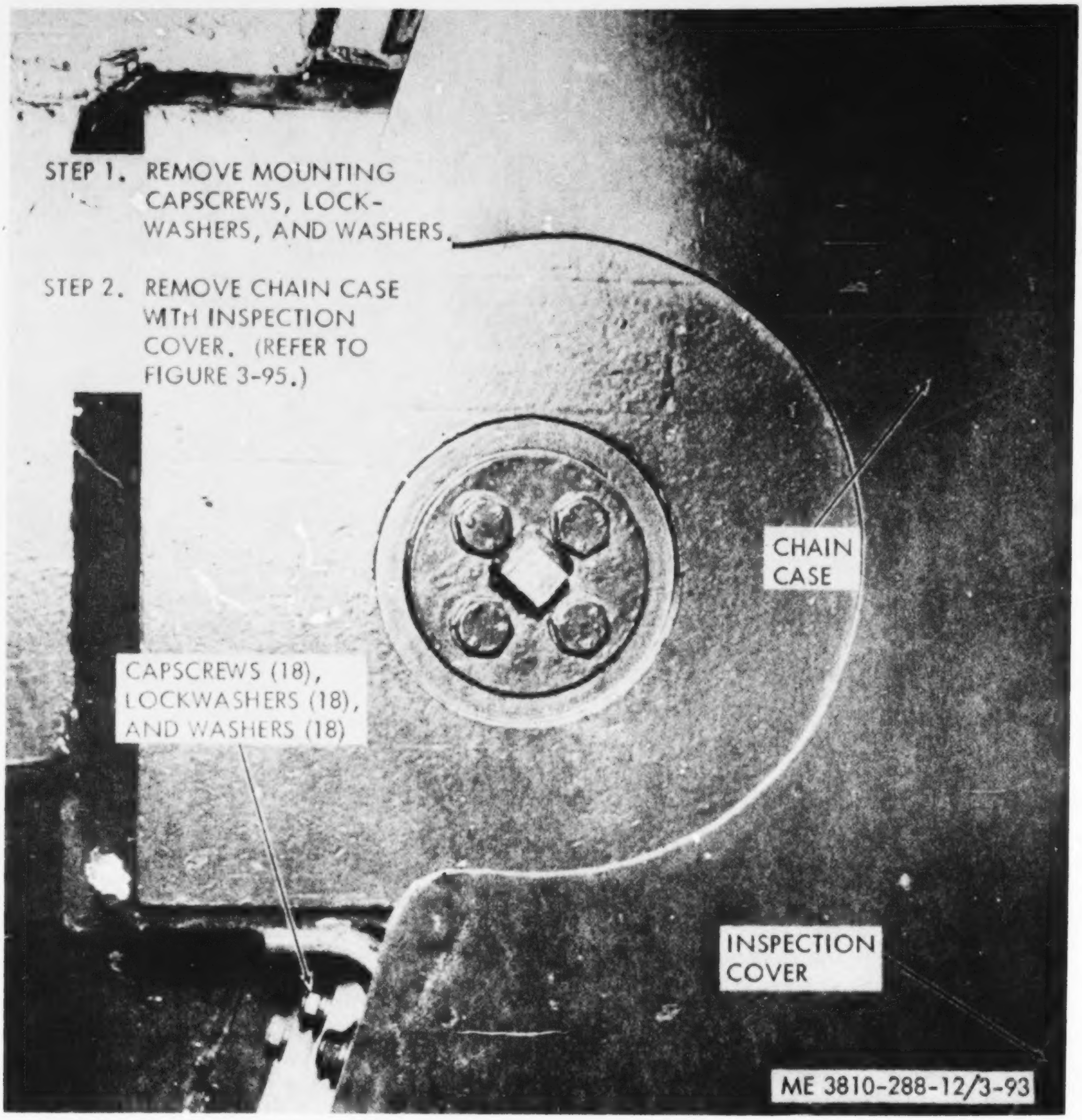
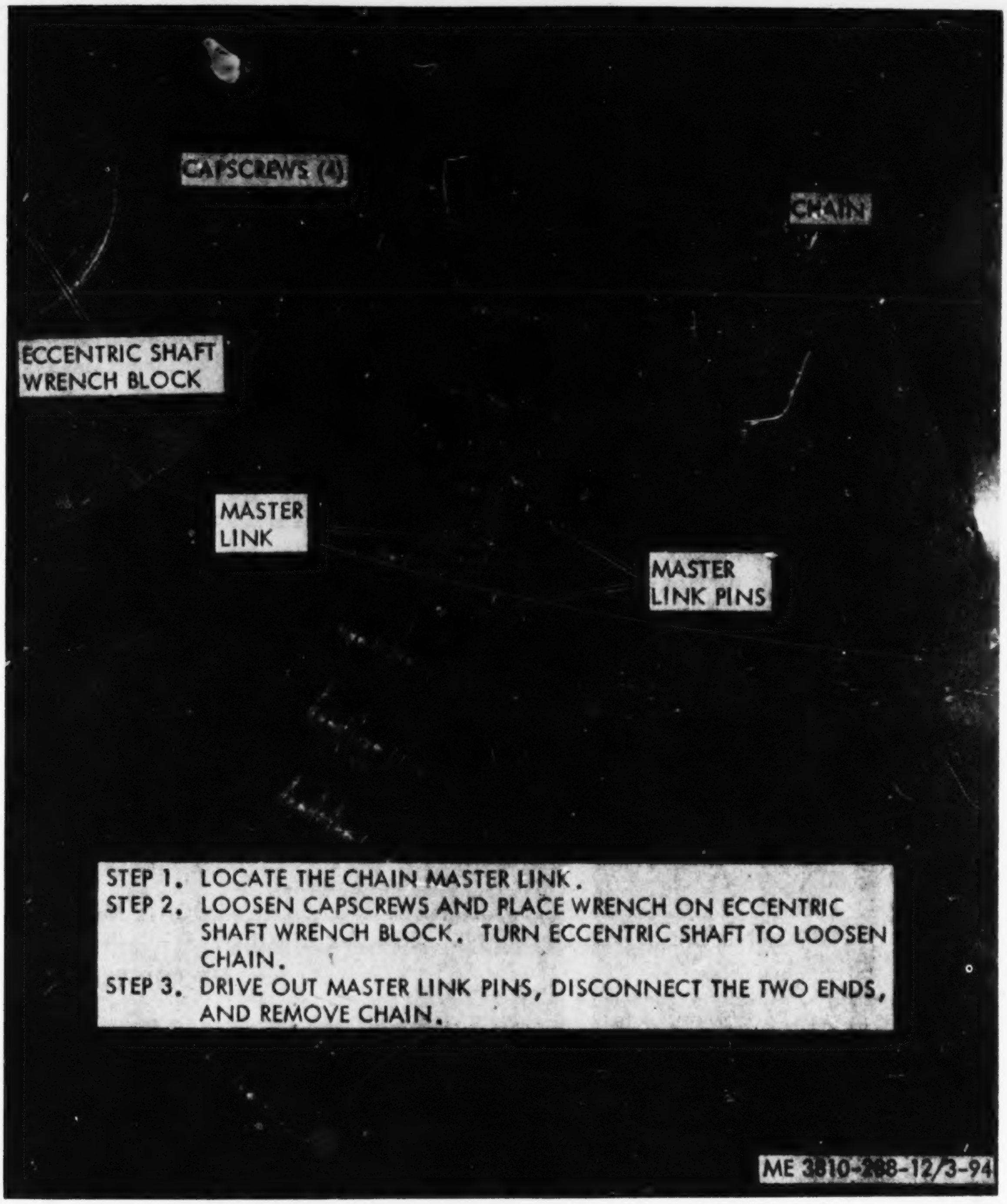

STEP 1. REMOVE MOUNTING CAPSCREWS, LOCK-WASHERS, AND WASHERS.
STEP 2. REMOVE CHAIN CASE WITH INSPECTION COVER. (REFER TO FIGURE 3-95.)
CHAIN CASE
CAPSCREWS (18), LOCKWASHERS (18), AND WASHERS (18)
INSPECTION COVER
ME 3810-288-12/3-93

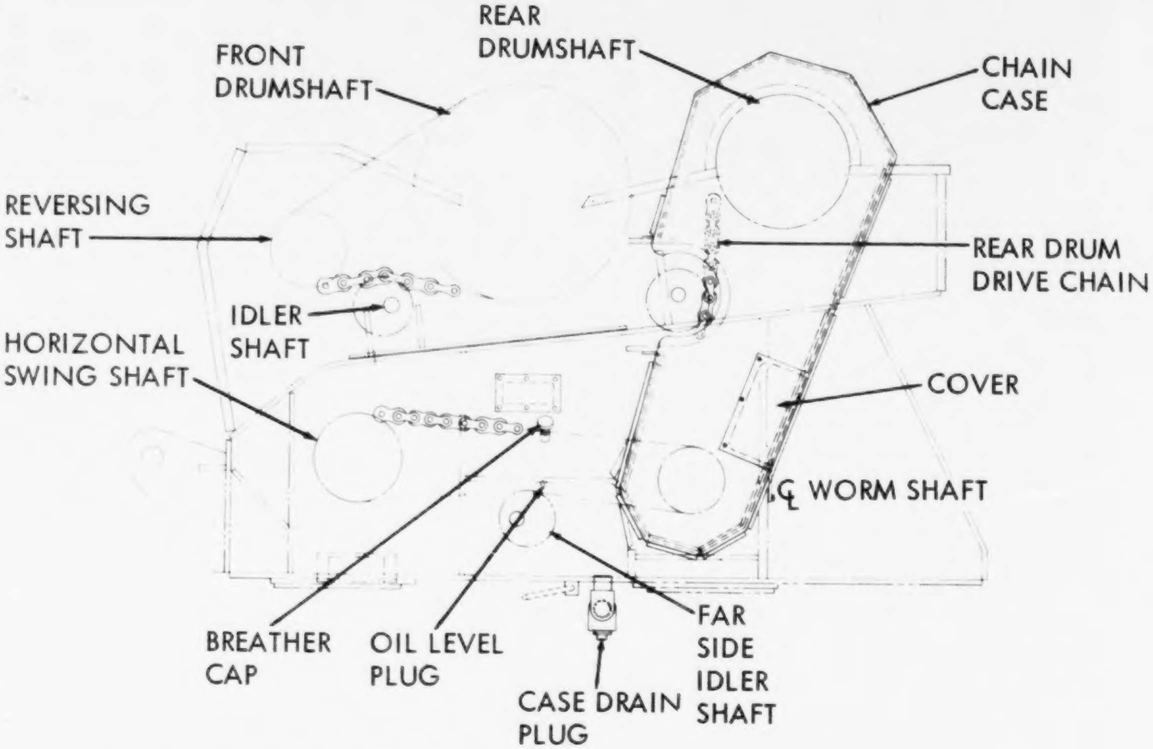
Figure 3-93. Rear drum chain case, removal and replacement.


CAPSCREWS (4)
CHAIN
ECCENTRIC SHAFT WRENCH BLOCK
MASTER LINK
MASTER LINK PINS

STEP 1. LOCATE THE CHAIN MASTER LINK.
STEP 2. LOSEN CAPSCREWS AND PLACE WRENCH ON ECCENTRIC SHAFT WRENCH BLOCK. TURN ECCENTRIC SHAFT TO LOOSEN CHAIN.
STEP 3. DRIVE OUT MASTER LINK PINS, DISCONNECT THE TWO ENDS, AND REMOVE CHAIN.

ME 3810-288-12/3-94

Figure 3–94. Rear drum drive chain, removal and replacement.


REAR DRUMSHAFT
FRONT DRUMSHAFT
CHAIN CASE
REVERSING SHAFT
REAR DRUM DRIVE CHAIN
IDLER SHAFT
HORIZONTAL SWING SHAFT
COVER
℄ WORM SHAFT
BREATHER CAP
OIL LEVEL PLUG
FAR SIDE IDLER SHAFT
CASE DRAIN PLUG

STEP 1. TURN REVOLVING FRAME SO MAIN GEARCASE DRAIN LINES UP WITH HOLE IN FRAME.

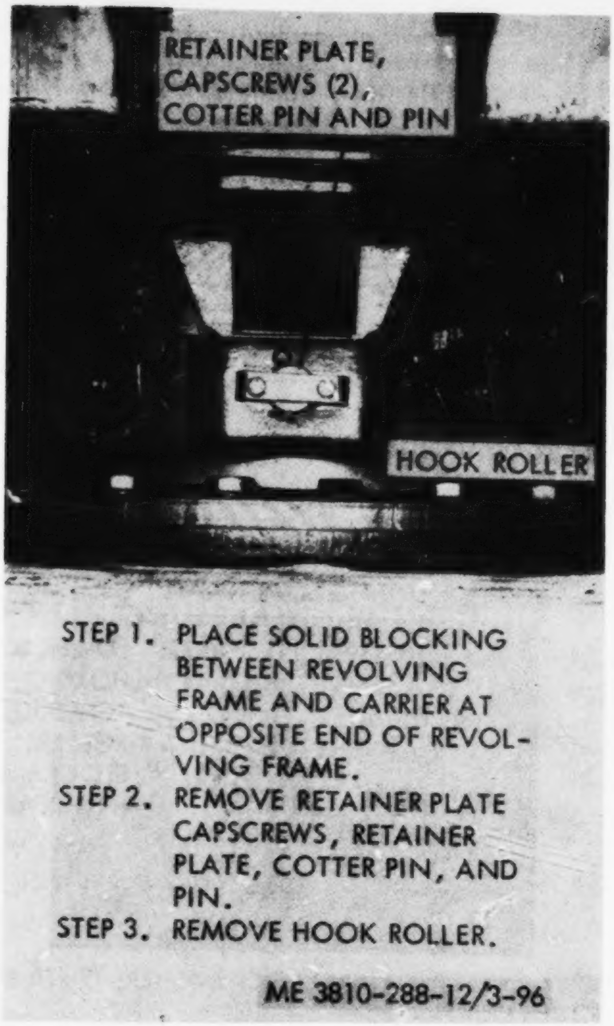
STEP 2. REMOVE CASE DRAIN PLUG. HAVE AN ADEQUATE CONTAINER FOR CASE OIL.

STEP 3. REMOVE COVER PLATE. REFER TO FIGURE 3-92.

STEP 4. REFER TO FIGURE 3-94 FOR VIEW OF MASTER LINK. LOCATE MASTER LINK AND DRIVE OUT LINK PINS. REMOVE CHAINS.

ME 3810-288-12/3-95

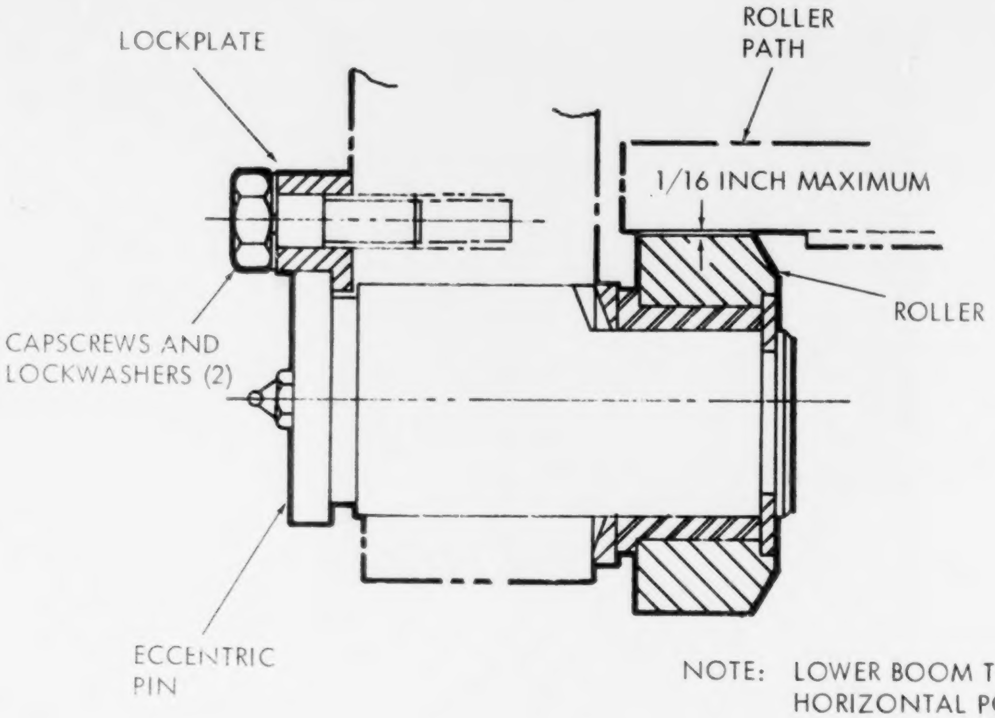
Figure 3-95. Horizontal swing shaft chains, removal and replacement.


RETAINER PLATE, CAPSCREWS (2), COTTER PIN AND PIN
HOOK ROLLER

STEP 1. PLACE SOLID BLOCKING BETWEEN REVOLVING FRAME AND CARRIER AT OPPOSITE END OF REVOLVING FRAME.
STEP 2. REMOVE RETAINER PLATE CAPSCREWS, RETAINER PLATE, COTTER PIN, AND PIN.
STEP 3. REMOVE HOOK ROLLER.

ME 3810-288-12/3-96

Figure 3-96. Hook rollers, removal and replacement.


LOCKPLATE
ROLLER PATH
1/16 INCH MAXIMUM
ROLLER
CAPSCREWS AND LOCKWASHERS (2)
ECCENTRIC PIN

NOTE: LOWER BOOM TO HORIZONTAL POSITION TO ADJUST FRONT HOOK ROLLER. REST BOOM ON BLOCKS WHEN ADJUSTING REAR HOOK ROLLERS.

STEP 1. REMOVE CAPSCREWS AND LOCKWASHERS (2 PER ROLLER). REMOVE LOCKPLATE.

STEP 2. PLACE WRENCH ON HEXAGONAL END OF ECCENTRIC PIN AND TURN PIN IN EITHER DIRECTION UNTIL THERE IS NO GAP BETWEEN ROLLER AND ROLLER PATH AT THE POINT SHOWN.

STEP 3. TURN ECCENTRIC PIN UNTIL THERE IS SOME GAP, BUT LESS THAN 1/16 INCH, BETWEEN ROLLER AND ROLLER PATH. MEASURE WITH FEELER GAGE.

STEP 4. INSTALL CAPSCREWS, LOCKWASHERS, AND LOCKPLATE.

ME 3810-288-12/3-97

Figure 3-97. Hook roller adjustment.

3-69. Swing Lock Assembly

a. General. The swing lock assembly mechanically prevents the revolving frame from moving in relation to the carrier.

b. Adjustment. Remove deck plates as required to obtain access to the swing lock assembly. Refer to figure 3-99. Refer to figure 3-98 and adjust the swing lock assembly, if the swing lock does not properly engage the swing ring gear.

c. Removal. Refer to figure 3-98 and remove the cotter pins and pins identified to remove the swing lock assembly.

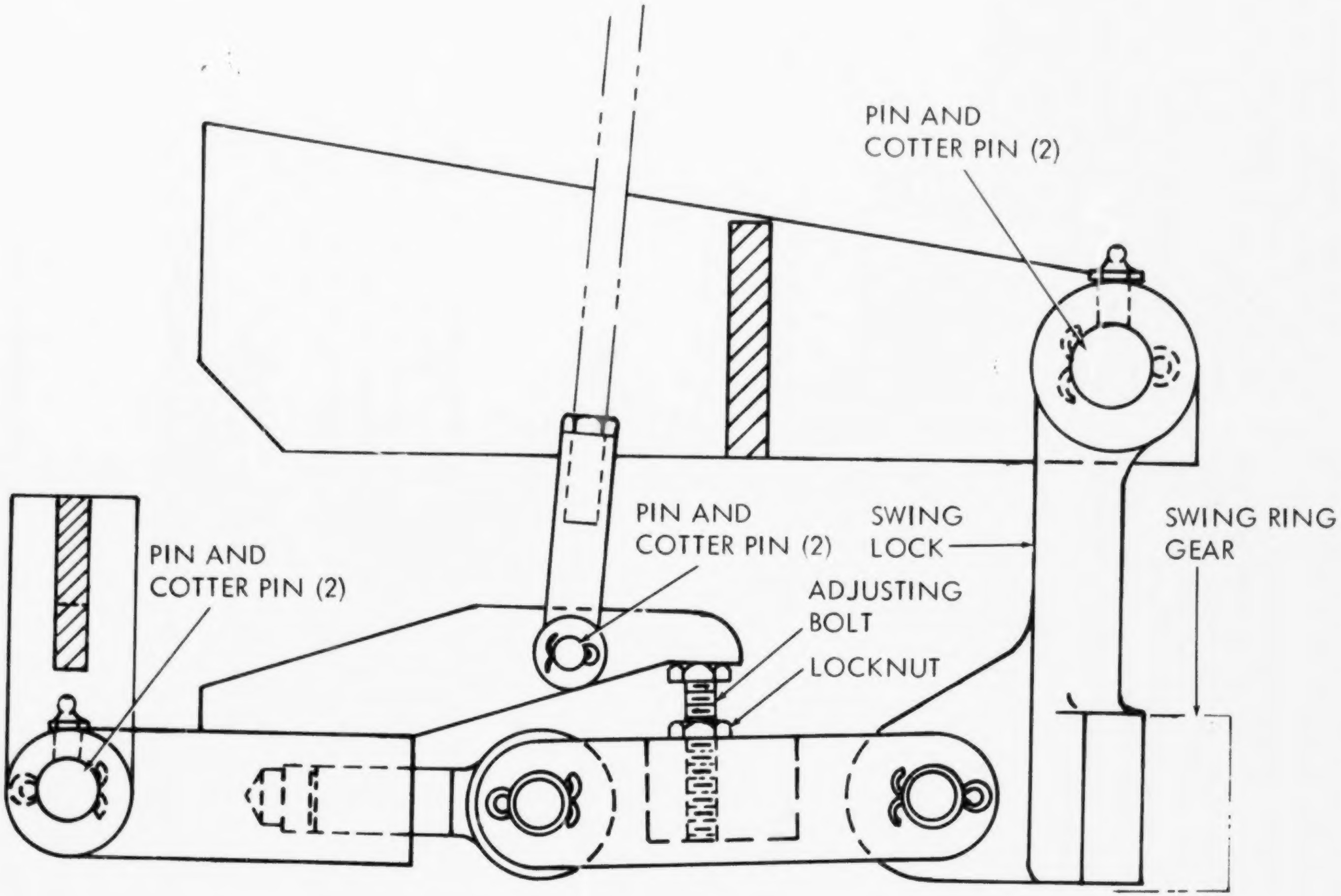
3-70. Gantry

Inspect the gantry visually. See that no evidence of cracks, bends, or damage is visible. Check the condition of gantry sheaves, paying careful attention to cracks or excessive grooving. Make sure that no points which require lubrication have been missed.

3-71. Cab Sheet Metal

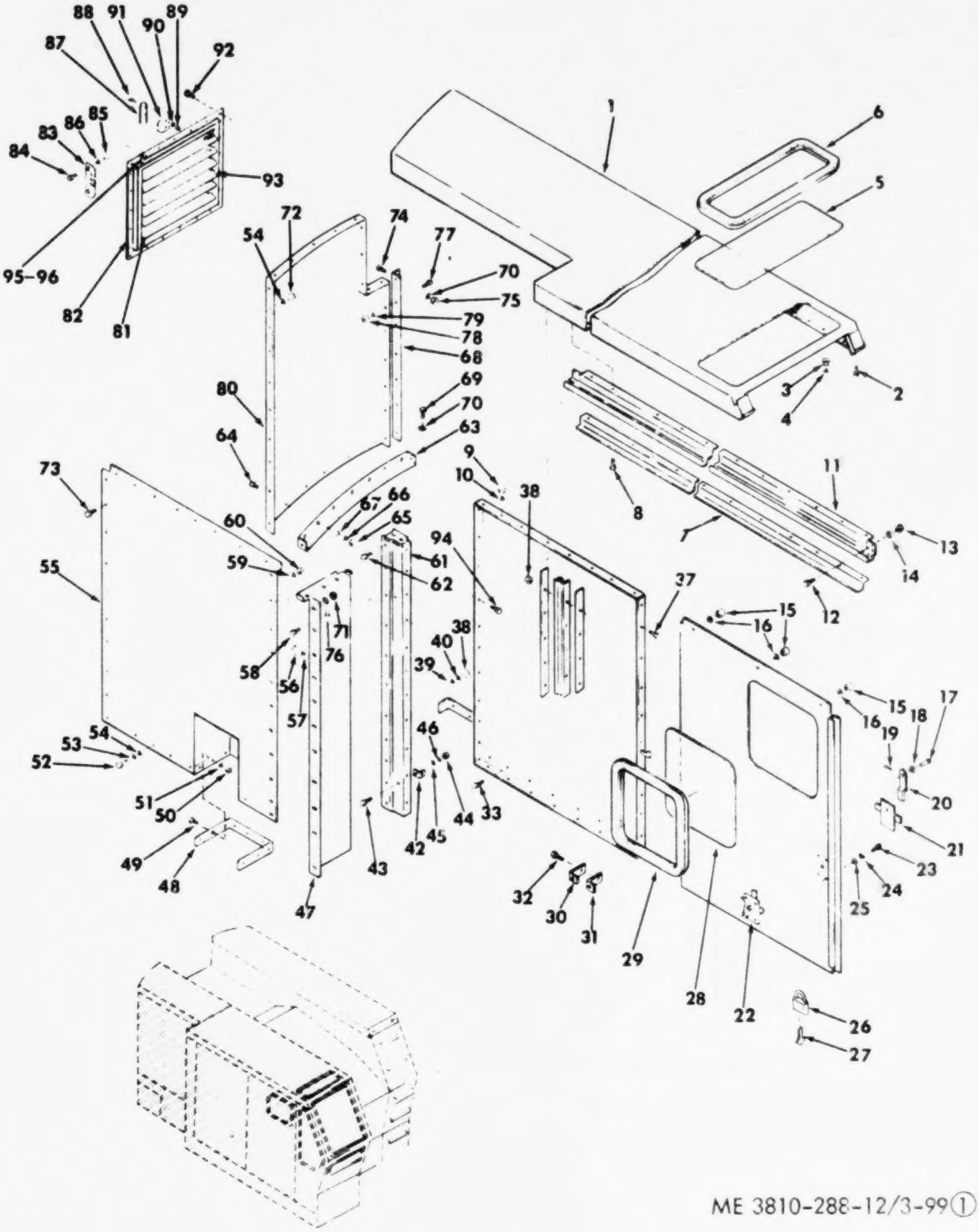
Figure 3-99 is an exploded view of all cab sheet metal. Refer to figure 3-99 to remove any necessary cab plates or components.

STEP 1. LOOSEN LOCKNUT.
STEP 2. TURN ADJUSTING BOLT UNTIL SWING LOCK ENGAGES FULLY WITH SWING RING GEAR.
STEP 3. TIGHTEN LOCKNUT.


PIN AND COTTER PIN (2)
PIN AND COTTER PIN (2)
SWING LOCK
SWING RING GEAR
PIN AND COTTER PIN (2)
ADJUSTING BOLT
LOCKNUT

ME 3810-288-12/3-98

Figure 3-98. Swing lock assembly, adjustment, removal and replacement.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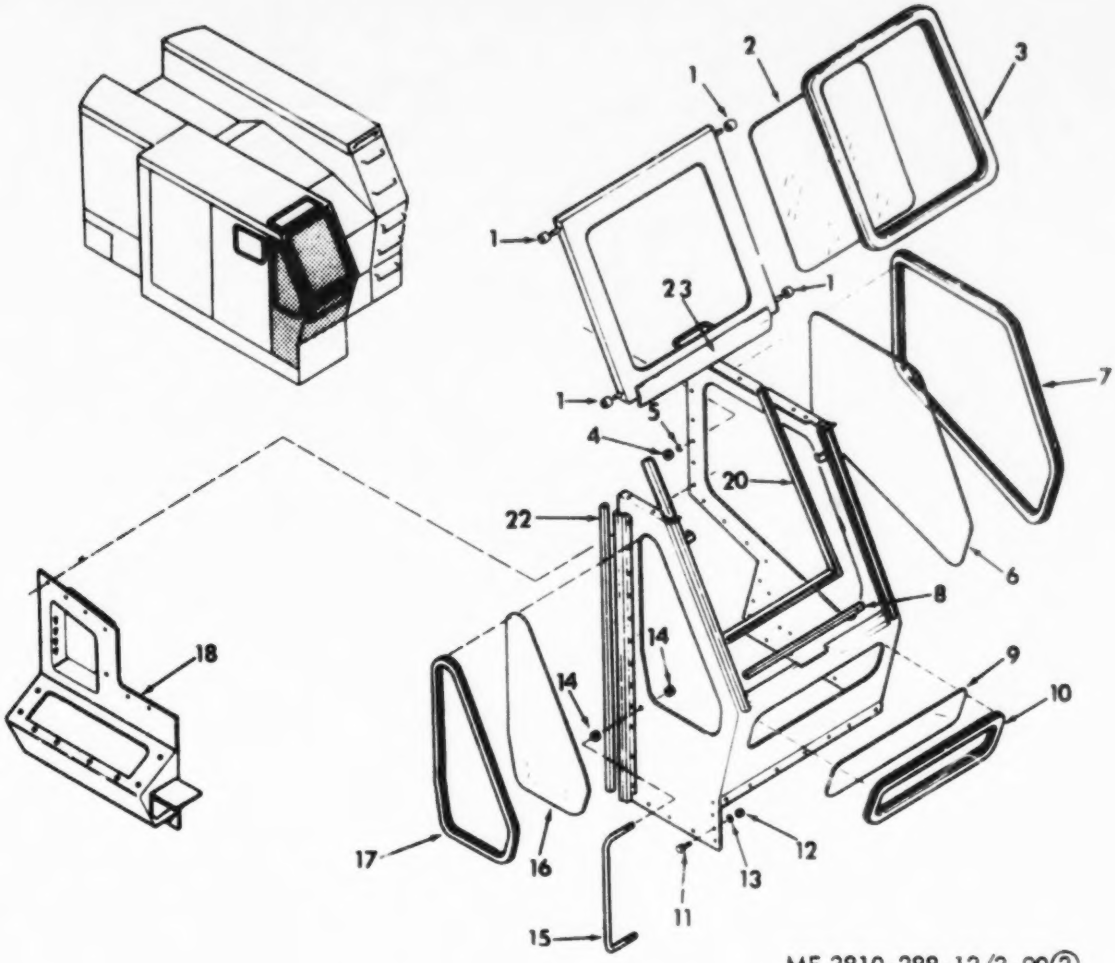
ME 3810-288-12/3-99①

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 1 of 6)

1. Canopy
2. Hex capscrew (30)
3. Nut (30)
4. Lock washer (30)
5. Safety glass
6. Weather strip
7. Guide
8. Capscrew (17)
9. Nut (17)
10. Lock washer (17)
11. Rain gutter
12. Capscrew (8)
13. Nut (8)
14. Lock washer (8)
15. Ball bearing (3)
16. Washer (3)
17. Capscrew (4)
18. Lock washer (4)
19. Cotter pin
20. Handle
21. Latch
22. Handle
23. Machine screws (2)
24. Lock washer (2)
25. Capscrew (4)
26. Lock
27. Key
28. Safety glass
29. Weather strip
30. Backup strip
31. Rubber seal strap
32. Roundhead machine screw (3)
33. Capscrew (8)
34. Backup strip
35. Rubber seal strap
36. Shim
37. Machine screw (13)
38. Nut (8)
39. Flat washer (8)
40. Lock washer (8)
41. Mounting plate
42. Bracket
43. Capscrew
44. Nut
45. Flat washer
46. Lock washer
47. Extension panel
48. Mounting plate
49. Capscrew (9)
50. Nut (9)
51. Lock washer (9)
52. Capscrew (6)
53. Flat washer (24)
54. Lock washer (24)
55. Rear side panel
56. Nut (11)
57. Lock washer (11)
58. Capscrew (14)
59. Lock washer (14)
60. Nut (14)
61. Side panel
62. Capscrew (23)
63. Mounting bracket
64. Capscrew (9)
65. Nut (9)
66. Flat washer (9)
67. Lock washer (9)
68. Angle
69. Capscrew (7)
70. Lock washer (35)
71. Nut (23)
72. Nut (18)
73. Capscrew (18)
74. Capscrew (28)
75. Nut (28)
76. Lock washer (23)
77. Capscrew (7)
78. Nut (7)
79. Lock washer (7)
80. Rear panel
81. Louver (6)
82. Louver bracket (6)
83. Positioning plate
84. Capscrew (2)
85. Nut (2)
86. Lock washer (2)
87. Control lever
88. Capscrew (2)
89. Nut (2)
90. Lock washer (2)
91. Actuating arm
92. Capscrew (16)
93. Shutter
94. Capscrew (11)
95. Operating rod
96. Ball joint (2)

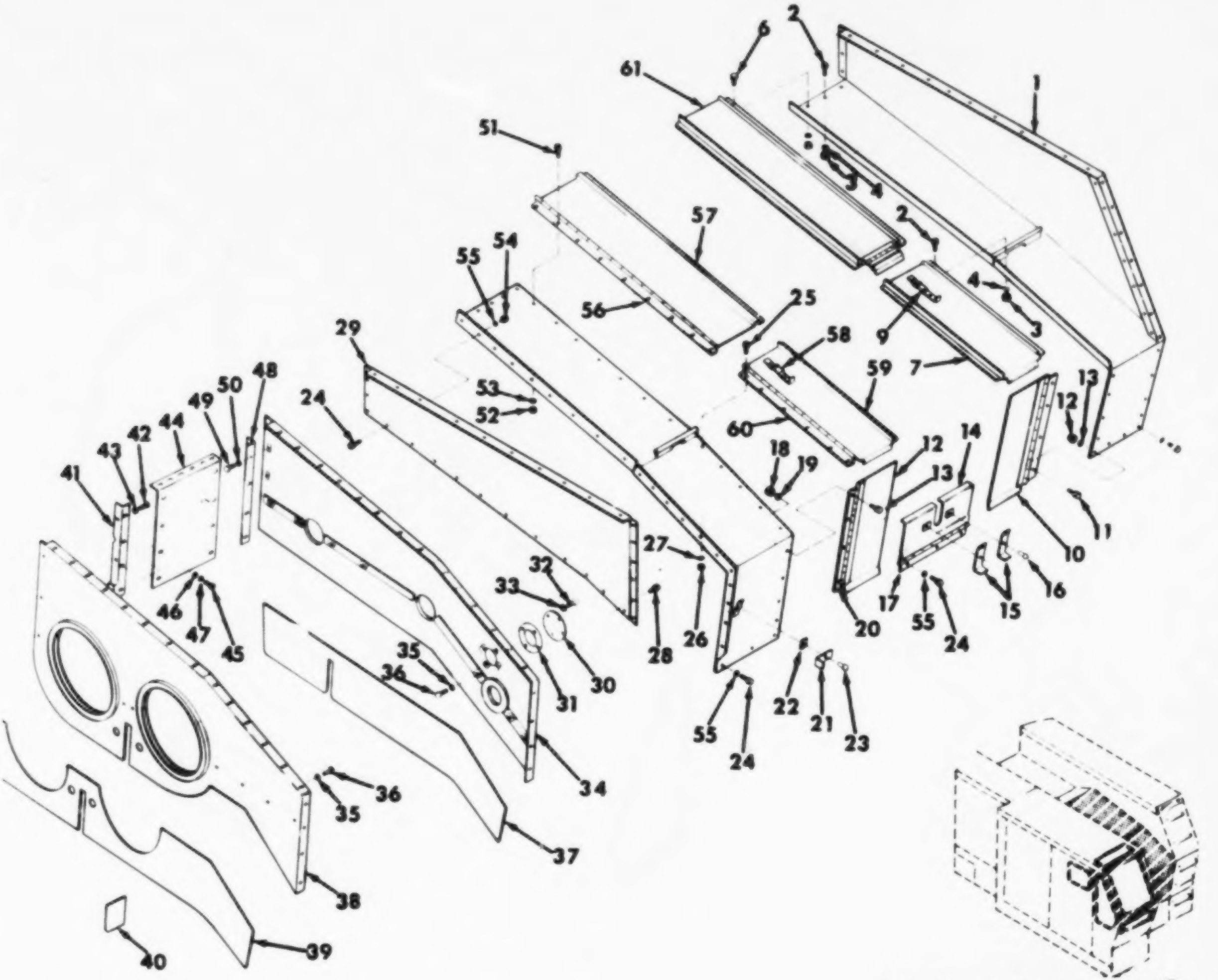
Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 1 of 6)



ME 3810-288-12/3-99②

1. Roller (4)
2. Safety glass
3. Weatherstrip
4. Nut
5. Lock washer
6. Safety glass
7. Weatherstrip
8. Rubber strip
9. Safety glass
10. Weatherstrip
11. Capscrew (19)
12. Nut (19)
13. Lock washer (19)
14. Nut (4)
15. Cab handle
16. Safety glass
17. Weatherstrip
18. Control box
19. Fastener (4)
20. Bracket
21. Washer (5)
22. Rubber strip
23. Rubber strip
24. Capscrew (12)
25. Nut (12)
26. Lock washer (12)

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 2 of 8)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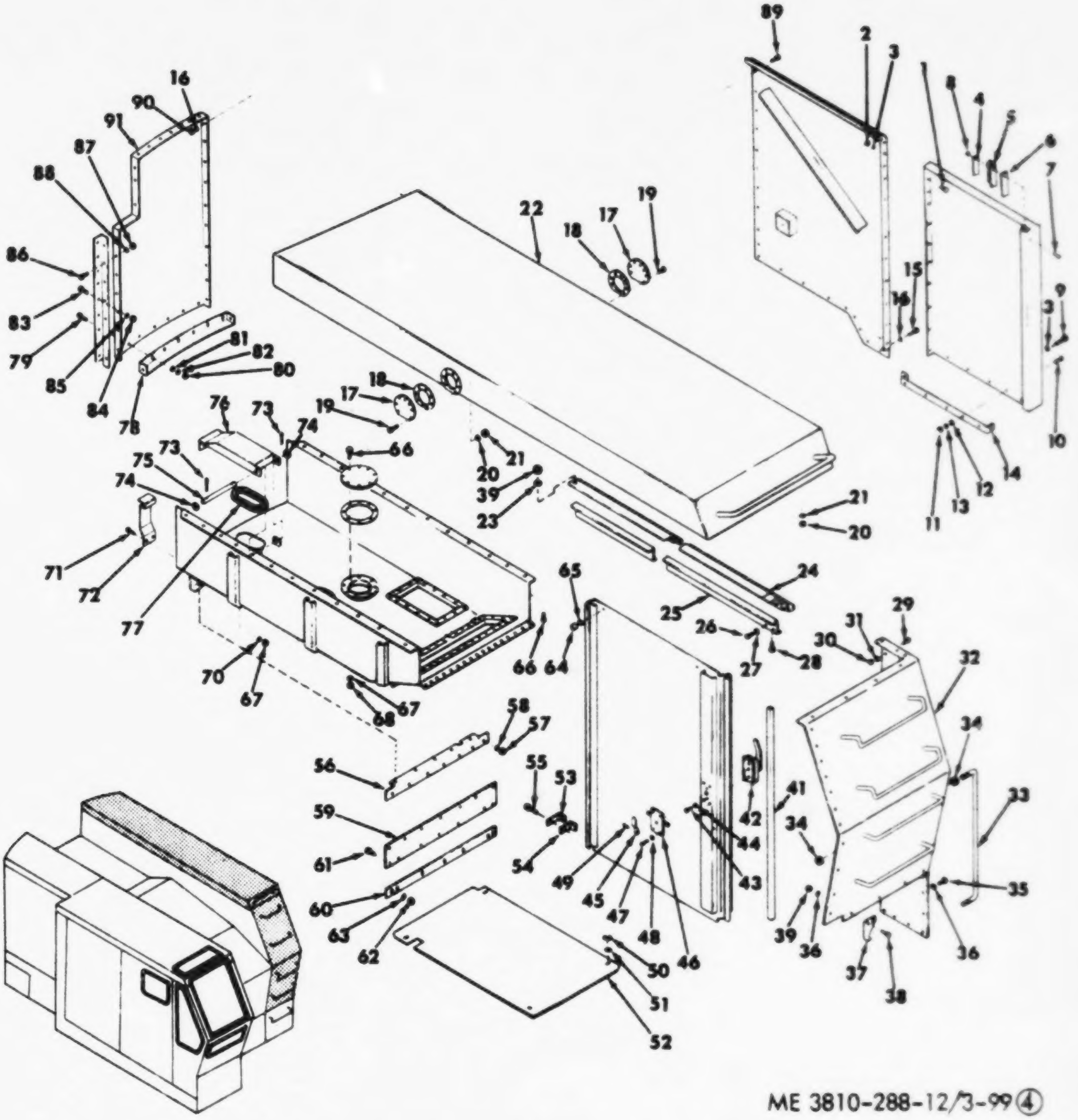
ME 3810-288-12/3-99③

1. Panel
2. Capscrew (30)
3. Nut (30)
4. Lock washer (30)
5. Left center cover
6. Capscrew (9)
7. Front cover
8. Hinge
9. Rivet
10. Left front cover
11. Capscrew (4)
12. Right front cover
13. Capscrew (4)
14. Bottom front cover
15. Latch (2)
16. Rivet (2)
17. Hinge
18. Nut (4)
19. Lock washer (4)
20. Hinge
21. Latch
22. Shim
23. Rivet
24. Capscrew (12)
25. Capscrew (24)
26. Nut (24)
27. Lock washer (24)
28. Capscrew (26)
29. Left side panel
30. Cover
31. Gasket
32. Oval stud (4)
33. Grommet (4)
34. Left enclosure
35. Lock washer (13)
36. Capscrew (13)
37. Left side plate
38. Right enclosure
39. Right side plate
40. Cover
41. Right panel angle
42. Capscrew (3)
43. Lock washer (3)
44. Center panel
45. Capscrew (8)
46. Flat washer (8)
47. Lock washer (8)
48. Left panel angle
49. Capscrew (2)
50. Lock washer (2)
51. Capscrew (9)
52. Nut (9)
53. Lock washer (9)
54. Nut (26)
55. Lock washer (38)
56. Hinge
57. Right center cover
58. Rivet
59. Front cover
60. Hinge
61. Hinge

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 3 of 6)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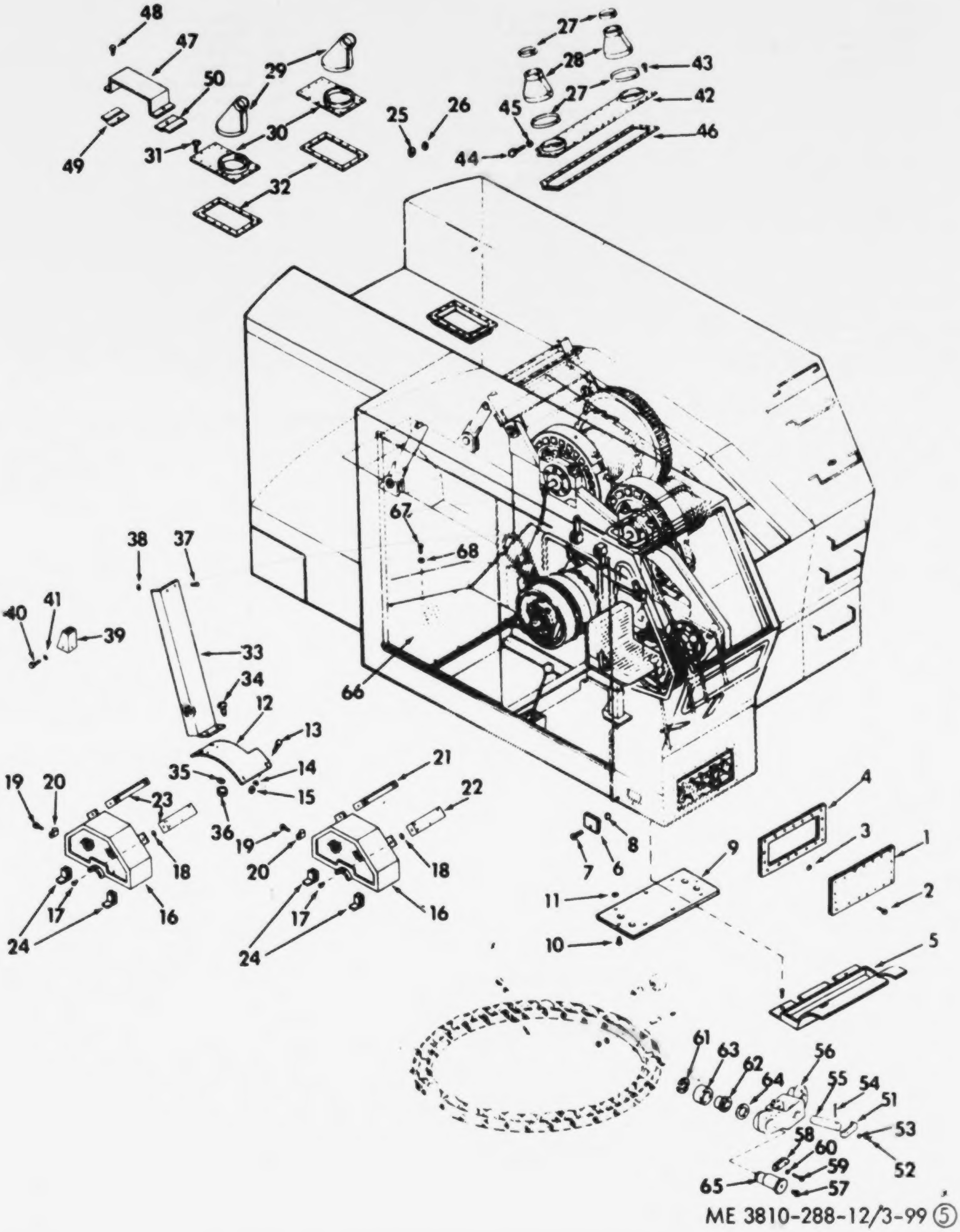
ME 3810-288-12/3-99④

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 4 of 8)

1. Capscrew (36)
2. Nut (36)
3. Lock washer (44)
4. Backup strip
5. Rubber strip
6. Shim
7. Machine screw (11)
8. Self-locking nut (11)
9. Capscrew (8)
10. Capscrew (8)
11. Nut (8)
12. Flat washer (8)
13. Lock washer (8)
14. Bracket
15. Capscrew (9)
16. Lock washer (31)
17. Cover plate (2)
18. Gasket (2)
19. Capscrew (14)
20. Nut (8)
21. Lock washer (8)
22. Left canopy
23. Lock washer (52)
24. Gutter
25. Guide
26. Capscrew (4)
27. Lock washer (4)
28. Capscrew (8)
29. Capscrew (13)
30. Nut (13)
31. Lock washer (13)
32. Left front panel
33. Cab handle
34. Nut (4)
35. Capscrew (12)
36. Lock washer (30)
37. Cover latch
38. Capscrew (18)
39. Nut (52)
40. Sliding door
41. Rubber strip
42. Handle
43. Machine screw (2)
44. Lock washer (2)
45. Plate
46. Latch
47. Capscrew (4)
48. Lock washer (4)
49. Cotter pin
50. Wing nut (4)
51. Lock washer (4)
52. Bottom engine cover
53. Backup strip
54. Rubber seal
55. Machine screw (3)
56. Angle
57. Nut (16)
58. Lock washer (16)
59. Bottom panel
60. Mounting plate
61. Capscrew (14)
62. Nut (14)
63. Lock washer (14)
64. Ball bearing (2)
65. Flat washer (2)
66. Capscrew (8)
67. Nut (8)
68. Lock washer (8)
69. Nut (2)
70. Lock washer (2)
71. Machine screw (2)
72. Spring lock
73. Cotter pin (2)
74. Flat washer (2)
75. Straight pin
76. Cover
77. Rubber strip
78. Bracket
79. Capscrew (9)
80. Nut (9)
81. Flat washer (9)
82. Lock washer (9)
83. Capscrew (20)
84. Nut (20)
85. Flat washer (20)
86. Capscrew (7)
87. Nut (7)
88. Lock washer (7)
89. Capscrew (22)
90. Nut (22)
91. Rear panel

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 4 of 6)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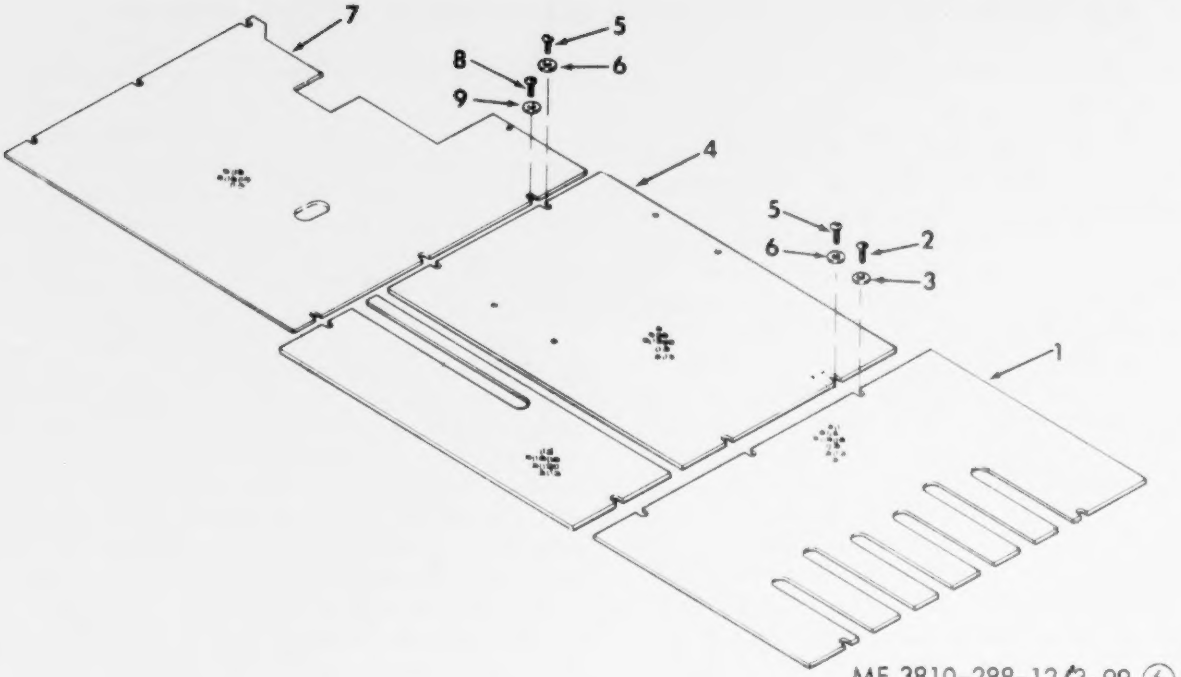
ME 3810-288-12/3-99 ⑤

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 5 of 6)

1. Cover
2. Fastener (16)
3. Plastic washer (16)
4. Gasket set
5. Dirt trough
6. Cover
7. Fastener
8. Plastic washer
9. Cover
10. Fastener (8)
11. Plastic washer (8)
12. Cover
13. Capscrew (4)
14. Lockwasher (44)
15. Nut (4)
16. Guard assembly (2)
17. Fastener (2)
18. Plastic washer (2)
19. Capscrew (2)
20. Loop clamp (2)
21. Bracket
22. Bracket
23. Bracket (2)
24. Bracket (4)
25. Flat washer
26. Flat washer
27. Boot clamp (8)
28. Gantry boot (2)
29. Gantry boot (2)
30. Cover (2)
31. Machine screw (16)
32. Gasket (2)
33. Cover
34. Capscrew (2)
35. Lockwasher (2)
36. Nut (2)
37. Fastener (4)
38. Plastic washer (4)
39. Cable cover
40. Capscrew (4)
41. Lockwasher (4)
42. Cab cover
43. Machine screw (29)
44. Machine screw (4)
45. Self-locking nut (4)
46. Gasket assembly
47. Cover
48. Capscrew
49. Bracket
50. Bracket
51. Retainer plate (3)
52. Capscrew (6)
53. Lock washer (6)
54. Cotter pin (3)
55. Pin (3)
56. Swivel arm (3)
57. Lube fitting (6)
58. Lock plate (6)
59. Capscrew (12)
60. Lockwasher (12)
61. Split retainer (6)
62. Hook roller (6)
63. Sleeve bearing
64. Thrust washer (6)
65. Eccentric pin (6)
66. Floor plate
67. Machine screw (6)
68. Flat washer (6)

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 5 of 6)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ME 3810-288-12/3-99 ⑥

1. Front floor plate	4. Floor plate	7. Floor plate
2. Machine screw (5)	5. Machine screw (6)	8. Machine screw (6)
3. Flat washer (5)	6. Flat washer (6)	9. Flat washer (6)

Figure 3-99. Cab sheet metal assembly, removal and replacement. (Sheet 6 of 6)

CHAPTER 4

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

4-1. Shipment

a. General. Detailed instruction for the preparation of the Model M320T Truck Crane for domestic shipment are outlined within this paragraph. Preparation will be accomplished in a sequence which will not require the operation of previously preserved components. See TM 740-90-1 and TM 740-93-2.

b. Inspection. The truck crane will be inspected for any unusual condition, such as rusty areas, leaks, missing parts, and accumulations of dirt or fluids. Inspection of the components and assemblies will be as outlined in the "Preventive Maintenance Service Quarterly", in this Manual.

c. Cleaning and Drying. The truck crane will be thoroughly cleaned and dried by approved methods. Approved methods of cleaning, drying, types of preservatives, and methods of application are described in TM 38-230.

d. Painting. Paint all surfaces where paint has been removed or damaged. Refer to TM9-213 for detailed cleaning and painting instructions.

e. Depreservation Guide. DA Form 2258, (Preservation and Depreservation Guide for Vehicles and Equipment).

(1) A properly annotated depreservation guide will be completed concurrently with preservation for each item of mechanical equipment. Any peculiar requirements will be outlined in the blank spaces on the form. The completed depreservation guide will be placed with the equipment in a waterproof envelope marked "Depreservation Guide", and fastened in a conspicuous location on or near the operator's controls.

(2) Prior to placing equipment in operation or to the extent necessary for inspection, depreservation of the item shall be performed as outlined on the depreservation guide.

f. Cooling System. Completely drain the cooling system including radiator and block, space heater, or other accessories through which the coolant has circulated. Flush with clean water.

g. Lubrication System (Wet Sump). Check level of lubricant. Operate the engines at fast idle until lubricant has been circulated throughout the system. The crankcase will then be drained and the drain plugs reinstalled.

h. Disassembly, Disassembled Parts, and Basic Issue Items.

(1) Disassembly shall be limited to the removal of parts and projecting components that tend to increase the overall profile of the Model M320T Truck Crane, and that which is subject to pilferage.

(2) Disassembled items shall be packed with the publications in the toolbox if possible. Otherwise items will be packed in a suitable container such as the one illustrated in figure 2-1 to prevent loss or pilferage.

Note. If packing is required to provide adequate protection against damage during shipment, refer to TM 38-230 for guidance in crate fabrication.

4-2. Limited Storage

a. Detailed instructions for preparation of the Model M320T Truck Crane for limited storage are provided in paragraph 4-1. Limited storage is defined as storage not to exceed six months.

b. Covered storage should be provided for the crane. If this is not possible, remove projecting components, cover with a protective tarpaulin or other suitable waterproof covering, and secure as required against wind and weather.

4-3. Demolition to Prevent Enemy Use

When capture or abandonment of the truck crane to the enemy is imminent, the responsible unit commander must make a decision either to destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent or destruction. Whatever method of demolition is employed, it is essential that the same vital parts of all truck cranes and all corresponding repair parts be destroyed. See TM 750-244-3.

PART TWO

CRANE LOWER (CARRIER)

CHAPTER 5

INTRODUCTION

Section I. GENERAL

5-1. Scope

a. This part of the manual primarily includes instructions for the operation of the lower (carrier portion) of the machine. Operator's and maintenance personnel should be carefully read the instructions provided in both parts of this manual before operating or servicing the equipment.

b. Refer to chapter 1 for detailed instructions for the use of this manual.

5-2. Forms and Records

Refer to chapter 1 for the forms and records to be used by operators and maintenance personnel, and for detailed instructions for the reporting of errors, omissions, and recommendations.

Section II. DESCRIPTION AND DATA

5-3. Description

a. General. The carrier for the Harnischfeger Model M320T truck crane provides the mounting base for the crane machinery, and the means by which the equipment can be transported from one work site to another.

b. Carrier. The carrier includes the carrier frame which supports the crane machinery, the front and tandem rear axle assemblies and suspension, the engine, transmission transfer case, and drive shafts, the operator's cab, and outriggers.

c. Engine. Power for operating the carrier is supplied by a 6-cylinder, overhead valve, 4-cycle, Waukesha, Model F-817-G, gasoline engine (fig. 5-1).

5-4. Identification and Tabulated Data

a. Refer to paragraph 1-4 for identification.

b. Refer to paragraph 1-4 for tabulated data.

c. Wiring diagram. See figure 5-2.

d. Hydraulic Steering System Diagram. Refer to figure 5-3.

e. Air Brake System Diagram. Refer to figure 5-4.

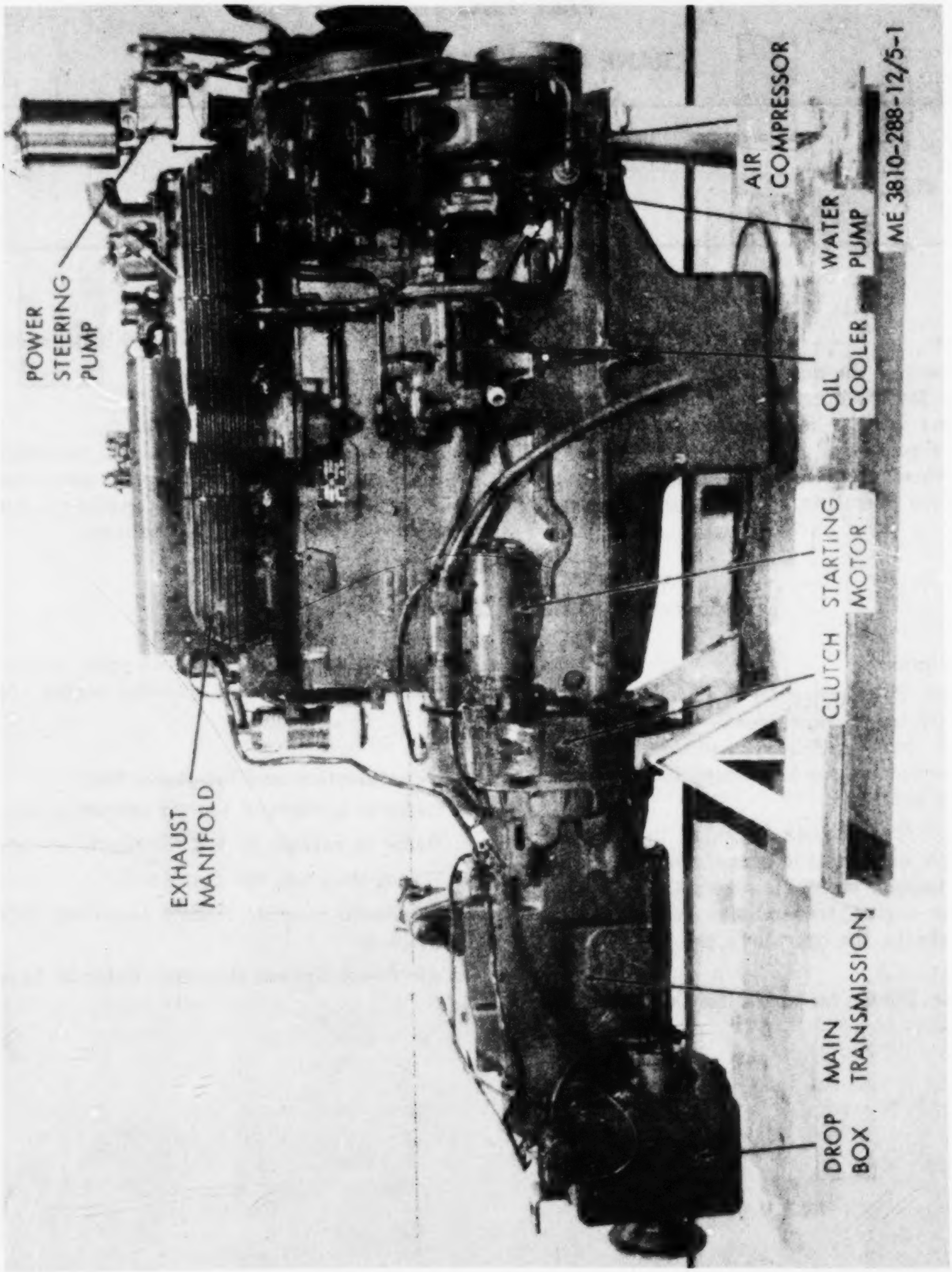
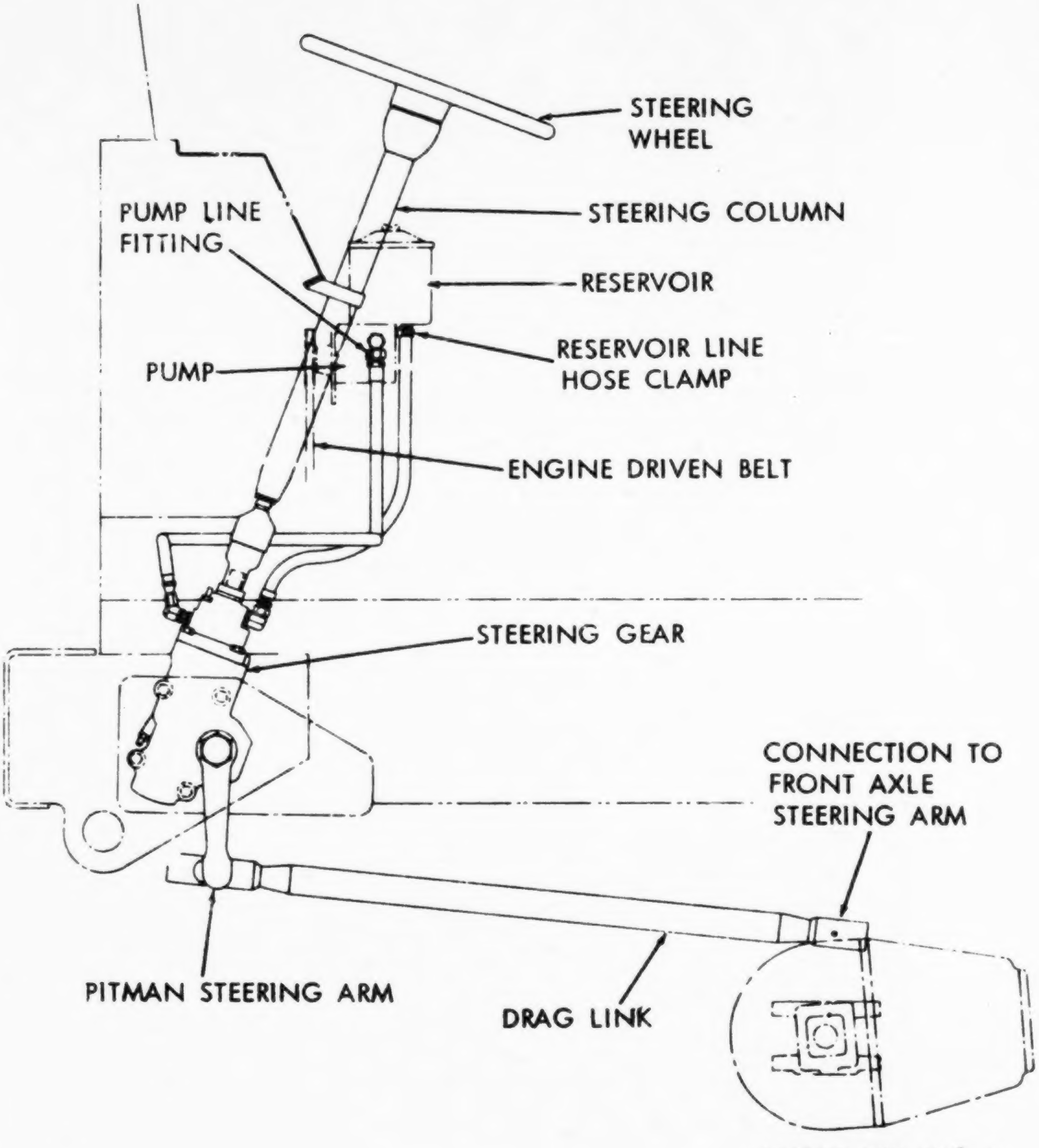

POWER STEERING PUMP
EXHAUST MANIFOLD
AIR COMPRESSOR
WATER PUMP
OIL COOLER
STARTING MOTOR
CLUTCH
MAIN TRANSMISSION
DROP BOX
ME 3810-288-12/5-1

Figure 5-1. Carrier engine, with transmission.

Figure 5-2. Carrier wiring diagram. (Sheet 1 of 3)
(Located in back of manual)

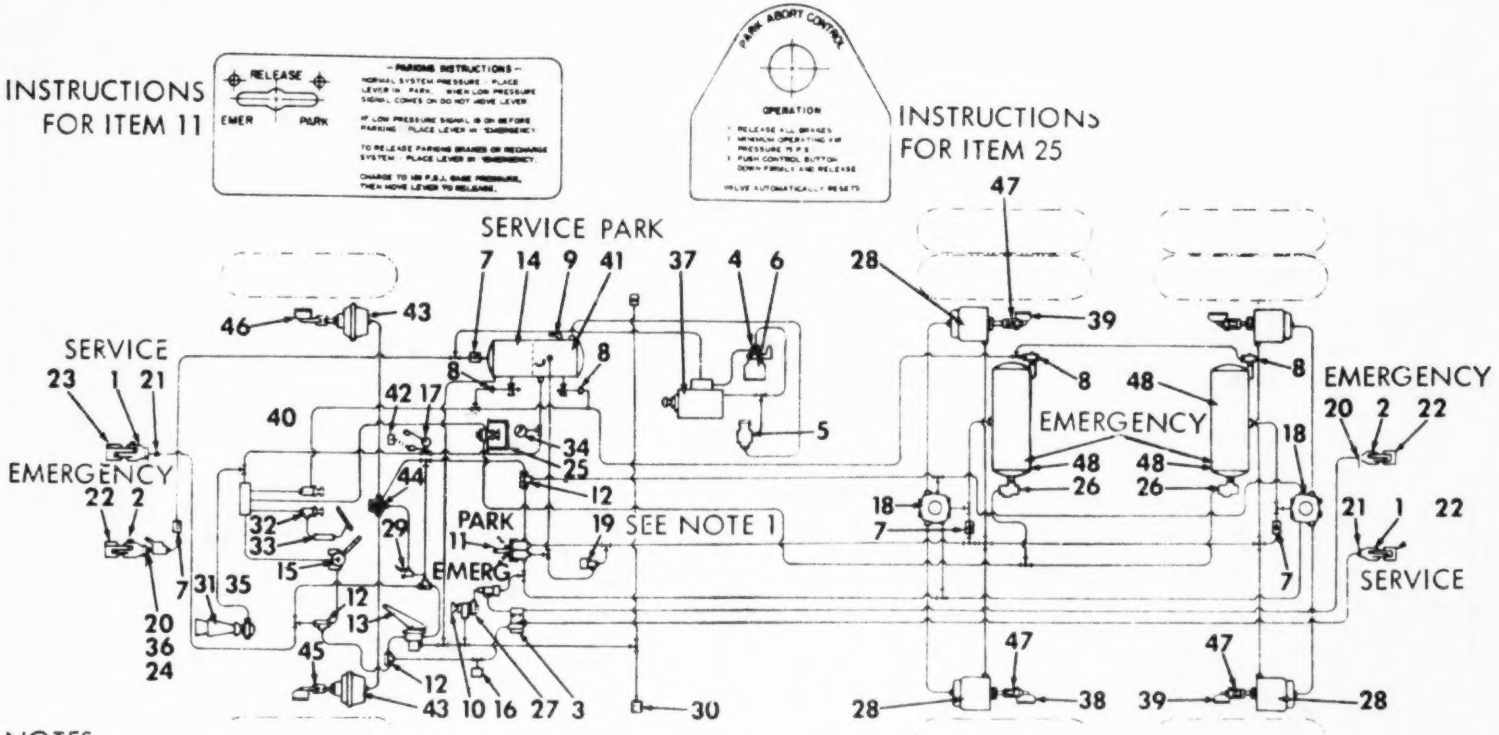
Figure 5-2. Carrier wiring diagram. (Sheet 2 of 3)
(Located in back of manual)

Figure 5-2. Carrier wiring diagram. (Sheet 3 of 3)
(Located in back of manual)


STEERING WHEEL
STEERING COLUMN
PUMP LINE FITTING
RESERVOIR
RESERVOIR LINE HOSE CLAMP
PUMP
ENGINE DRIVEN BELT
STEERING GEAR
CONNECTION TO FRONT AXLE STEERING ARM
PITMAN STEERING ARM
DRAG LINK

ME 3810-288-12/5-3

Figure 5-3. Hydraulic steering system diagram


INSTRUCTIONS FOR ITEM 11
RELEASE
EMER
PARK
- PARKING INSTRUCTIONS -
NORMAL SYSTEM PRESSURE - PLACE LEVER IN PARK. WHEN LOW PRESSURE SIGNAL COMES ON DO NOT MOVE LEVER.
IF LOW PRESSURE SIGNAL IS ON BEFORE PARKING PLACE LEVER IN "EMERGENCY"
TO RELEASE PARKING BRAKES OR RECHARGE SYSTEM - PLACE LEVER IN "EMERGENCY".
CHARGE TO 100 P.S.I. GAGE PRESSURE, THEN MOVE LEVER TO RELEASE.
PARK ABORT CONTROL
OPERATION
1 RELEASE ALL BRAKES
2 MINIMUM OPERATING AIR PRESSURE 75 P.S.I.
3 PUSH CONTROL BUTTON DOWN FIRMLY AND RELEASE
VALVE AUTOMATICALLY RESETS
INSTRUCTIONS FOR ITEM 25
SERVICE PARK
7 14 9 41 37 4 6
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NOTES:

1. SET TO CLOSE AT 75 PSI.
2. VALVE (25) SHOWN IN "RELEASE" POSITION. OPERATE VALVE AS FOLLOWS:
   A. NORMAL SYSTEM PRESSURE - PLACE LEVER IN "PARK". WHEN LOW PRESSURE SIGNAL COMES ON, DO NOT MOVE LEVER.
   B. IF LOW PRESSURE SIGNAL IS ON BEFORE PARKING, DO NOT PLACE LEVER IN "PARK" PLACE LEVER IN "EMERGENCY".
   C. TO RELEASE PARKING BRAKES OR RECHARGE SYSTEM, PLACE LEVER IN "EMERGENCY". CHARGE SYSTEM TO 100 PSI. THEN MOVE LEVER TO "RELEASE" POSITION.
3. VALVE (25) HAS A COVER TO PREVENT ACCIDENTAL ACTUATION. OPERATE THIS PARK ABORT CONTROL VALVE AS FOLLOWS:
   A. RELEASE ALL BRAKES.
   B. CHECK GAUGE (34) PRESSURE. IT MUST BE 75 PSI MINIMUM.
   C. PUSH VALVE (25) BUTTON DOWN FIRMLY AND HOLD DEPRESSED FOR ONE MINUTE. THE VALVE AUTOMATICALLY RESETS WHEN RELEASED.

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Figure 5-4. Air brake system diagram.

1. Hose coupling
2. Hose coupling
3. Tractor protection valve
4. Check valve
5. D-2 Governor
6. Alcohol evaporator
7. Check valve
8. Drain valve
9. Safety valve
10. PP-3 Control valve
11. 3-Way control valve
12. Double check valve
13. E-3 Brake valve
14. Reservoir (service)
15. TC-2 Brake valve
16. Stop light switch
17. Low pressure indicator
18. Relay emergency valve
19. PR-2 Pressure protection
20. Emergency tag
21. Service tag
22. Dummy coupling
23. Dummy coupling
24. Clamping stud
25. PP-1 Valve (choke vent)
26. AS-1 Control valve
27. SV-1 Valve (with choke fitting)
28. SD-3 Brake chamber
29. TW-1 Control valve
30. Coupling body
31. Air horn
32. Wiper control
33. Windshield wiper
34. Air gauge
35. Junction block (manifold)
36. Cut-out cock
37. TU-FLO Air compressor
38. Slack adjuster
39. Slack adjuster
40. HV-4 Drain valve
41. Reservoir (park)
42. Low pressure indicator buzzer
43. Brake chamber
44. Limiting and quick release valve
45. Slack adjuster
46. Slack adjuster
47. Mechanical release yoke
48. Reservoir (emergency)

Figure 5-4. Air brake system diagram.

CHAPTER 6

INSTALLATION AND OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

6–1. Inspecting and Servicing the Equipment

Refer to paragraph 2–1 for inspection and services to be performed on the equipment upon receipt of materiel.

6–2. Installation of Separately Packed Components

Refer to paragraph 2–2 for installation instructions of the separately packed carrier components.

6–3. Installation or Setting Up Instructions

Refer to paragraph 2–3 for instructions on the operations to be performed on arrival at the work site.

Section II. MOVEMENT TO A NEW WORK SITE

6–4. Dismantling for Movement

Refer to paragraphs 2–11 and 2–12 for instructions on the dismantling of the equipment before movement to a new work site.

6–5. Reinstallation after Movement

Refer to paragraphs 2–11 and 2–12 and reinstall the equipment after movement to a new work site.

Section III. CONTROLS AND INSTRUCTIONS

6–6. General

This section describes the various controls and instruments and provides the operator/crew with sufficient information to insure proper operation of the Model M320T truck crane carrier.

6–7. Controls and Instruments

a. General. The carrier operating controls and instruments are shown in figure 6–1. A description of each control is given below. The controls are listed in the order of their appearance on figure 6–1.

Note. The operator must study the information in this section, and be thoroughly familiar with location and function of each control, before attempting to operate the machine.

b. Controls.

(1) *Master light switch.* The master light control switch has three handles. They are:

(*a*) *Lock lever.* This lever prevents the outside lamp selector lever (lever B) from moving, except into the blackout position. This prevents accidental actuation of lights under blackout conditions. Move this lever upward and hold to allow lever B to be turned to any position other than blackout.

(*b*) *Outside lamp selector switch.* This lever has five positions, as follows:

1. Blackout drive
2. Blackout marker
3. Off
4. Stop lights
5. Service drive

The desired combination of lights may be selected by the operator by lifting lock lever A and turning switch B.

(*c*) *Panel light selector switch.* This switch selects the type of panel lighting, in four positions, as follows:

1. Park
2. Off
3. Dim
4. Bright

(2) *Cab dome light switch.* This switch controls the cab dome lights.

(3) *Oil temperature warning light.* This

light will turn on when oil pressure is below the safe maximum.

(4) *Water temperature warning light.* This light will turn on when water temperature is above the safe maximum.

(5) *Engine oil pressure gauge.* This gauge indicates the oil pressure in the carrier engine. Normal oil pressure is 40 psi, with an acceptable variations of 5 psi above or below.

(6) *Left turn directional lamp.* This lamp will "blink" when the directional turn lever is pulled downward to signal a left turn.

(7) *Speedometer/odometer.* This instrument indicates the carrier speed in miles per hour and accumulated total carrier mileage.

(8) *High beam indicator.* This lamp is illuminated when the carrier headlights are on high beam.

(9) *Tachometer/hourmeter.* This instrument indicates engine speed in hundreds of revolutions per minute and accumulated engine operating time in hours.

(10) *Right turn directional lamp.* This lamp will "blink" when the directional turn lever is pulled downward to signal a left turn.

(11) *Air pressure gauge.* This gauge indicates air pressure in the air brake system in pounds per square inch (psi).

(12) *Park abort control.* This control is used to drain down air pressure in the air brake system and maintain the brake shoes out of contact with the brake drums for long term parking when it is necessary to be sure brake shoes do not freeze to brake drums. See the description of operation in paragraph 6-8.

(13) *Engine throttle control.* Pull out on this control to increase engine idle speed. Push in on the control to decrease engine speed.

(14) *Reservoir drain valve.* Depress and hold this valve depressed to drain all air pressure from the air brake reservoir. Refer to paragraph 6-8.

(15) *Tractor protection valve.* This valve is used only when towing another vehicle, and should not be pushed in when another vehicle is not being towed. In normal towing service, push the valve in. In an emergency, if it becomes necessary to apply the brakes of the towed vehicle, pull this valve out.

(16) *Emergency-release-park lever.* This lever selects the basic mode of operation of the air brake system. Place the lever in the RELEASED position for normal operation. Place the lever in the EMERGENCY position for short term parking. Place the lever in the PARK position for long term parking. Refer to paragraph 6-8 for a more complete description of brake system operation.

(17) *Starting aid.* Push this lever three or four strokes to inject engine fuel into the engine intake manifold to assist in starting the carrier engine in cold weather. Wait about five second after injecting the fuel before attempting to start the engine.

(18) *Interaxle differential lockout.* When very slippery road conditions are encountered, or when very bumpy off-road conditions are encountered, depress this pushbutton and hold it depressed for maximum traction. This control should be used only when really necessary, since it imposes extra strain on axle mechanisms.

(19) *Dry road-slippery road switch.* Place this lever in the SLIPPERY ROAD position when slippery driving conditions are encountered. This will reduce air brake pressure to front wheel service brakes by 50 per cent, thus assisting in preventing skidding. Return to the DRY ROAD position as soon as conditions will allow.

(20) *Windshield wiper switch.* This switch turns the windshield wipers on and off.

(21) *Fuel level gauge.* This gauge indicates the remaining amount of fuel in the fuel tank.

(22) *Panel lamp.* Turn to illuminate panel.

(23) *Panel lamp.* Turn to illuminate panel.

(24) *Water temperature gauge.* This gauge indicates water temperature in degrees Fahrenheit. Normal temperature, while running, is between 160 and 200 degrees.

(25) *Cab heater switch.* Turn this switch to start the cab heater.

(26) *Panel lamp.* Turn to illuminate panel.

(27) *Battery-generator indicator.* This device is a voltmeter and is designed to indicate the condition of the battery and to assist in diagnosing other troubles. Refer to figure 2-37 for further information.

(28) *Ignition switch.* Turn this switch clockwise to turn on the engine ignition. Turn the switch counterclockwise to turn the ignition off.

(29) *Hazard warning switch light.* This light will blink when the hazard warning switch (item 30) is turned on.

(30) *Hazard warning switch.* This switch turns on flashing lights at all four corners of the carrier. (item 45).

(31) *Horn button.* Depress this button to sound the carrier horn.

(32) *Directional signal lever.* Pull this lever down to turn on the left turn directional signal. Push this lever up to turn on the right turn directional signal.

(33) *Trailer brake lever.* When towing another vehicle, pull this lever down to apply the brakes of the towed vehicle.

(34) *Windshield washer control.* Depress this button to squirt windshield cleaning fluid on the windshield.

(35) *Headlight dimmer switch.* Depress this switch to change from low beam headlights to high beam. Depress the switch again to reverse the process.

(36) *Clutch pedal.* Depress this pedal to disengage the carrier engine clutch while shifting gears.

(37) *Brake treadle valve.* Depress this pedal to apply the carrier service brakes, and the brakes on the towed vehicle, when towing another vehicle.

(38) *Accelerator pedal.* Depress this pedal to increase carrier speed.

(39) *Main transmission shift lever.* Depress clutch pedal (item 36) and shift the main transmission as indicated on the transmission shift instruction plate on the carrier dash. Refer to paragraph 6–9.

(40) *Transmission shift button.* Pull up on this button to shift the main transmission from the low speed range to the high speed range, or push it down to shift from the high speed range to the low speed range.

(41) *Transfer case control lever.* Place this lever in HIGH for normal highway driving. Place the lever in LOW for off-highway driving. A neutral position is also available. Stop the carrier before shifting.

(42) *Front axle control lever.* Place this lever in the IN position when front wheel drive is to be used. Keep the lever in the OUT position when driving under normal highway conditions.

(43) *Low air pressure indicator.* This flag type indicator will allow the flag to drop when air pressure drops below the safe operating range.

(44) *Windshield wiper hand lever.* This lever may be used to operate the windshield wiper blade manually.

(45) *Emergency switch.* Redundant hazard warning switch. Same function as item 30.

6–8. Brake System Operation

a. Driving Normally. There are three positions of EMERGENCY-RELEASE-PARK lever (fig. 6–1, item 16). To operate the carrier normally, drive to the work site in the RELEASE position, stop the carrier, and place the control in the EMERGENCY position. This position is used for short term parking. When ready to move, flip the control to the RELEASE position and drive away.

b. Overnight Parking. When through working for the day, or when intermediate term parking (several hours) is required, drive to the point where the carrier will be parked. Stop the carrier and place the lever (fig. 6–1, item 16) in the PARK position. This will drain air pressure from the system and mechanically engage the carrier brakes. When ready to move the carrier again, start the engine, place the lever in the EMERGENCY position, and wait until the low pressure indicator flag (fig. 6–1, item 43) goes up. This may take as much as five minutes, and there may be an interval at about 95 psi air pressure when the charging seems to slow down. This is normal and should be overlooked. Also, the low air pressure buzzer will be on while the air pressure flag goes up, place the lever in the RELEASE position and drive the carrier normally.

c. Park Abort. When it is desired to park the carrier for a very long period of time, it is placed in the PARK ABORT condition by means of item 12, figure 6–1. Under these circumstances, the air supply is bled out of the entire system and the brake shoes are mechanically prevented from coming in contact with the brake drums.

***Warning:* While in the park abort condition, the carrier will have no brakes. Always block the wheels so as to prevent truck crane motion before placing the machine in the park abort condition. Do not remove blocking until the carrier is returned to normal brake system operation as follows:**

(1) Start engine.

(2) Place lever (fig. 6–1, item 16) in EMERGENCY position and run engine until the low air pressure flag rises, indicating system pressure is within the operating range.

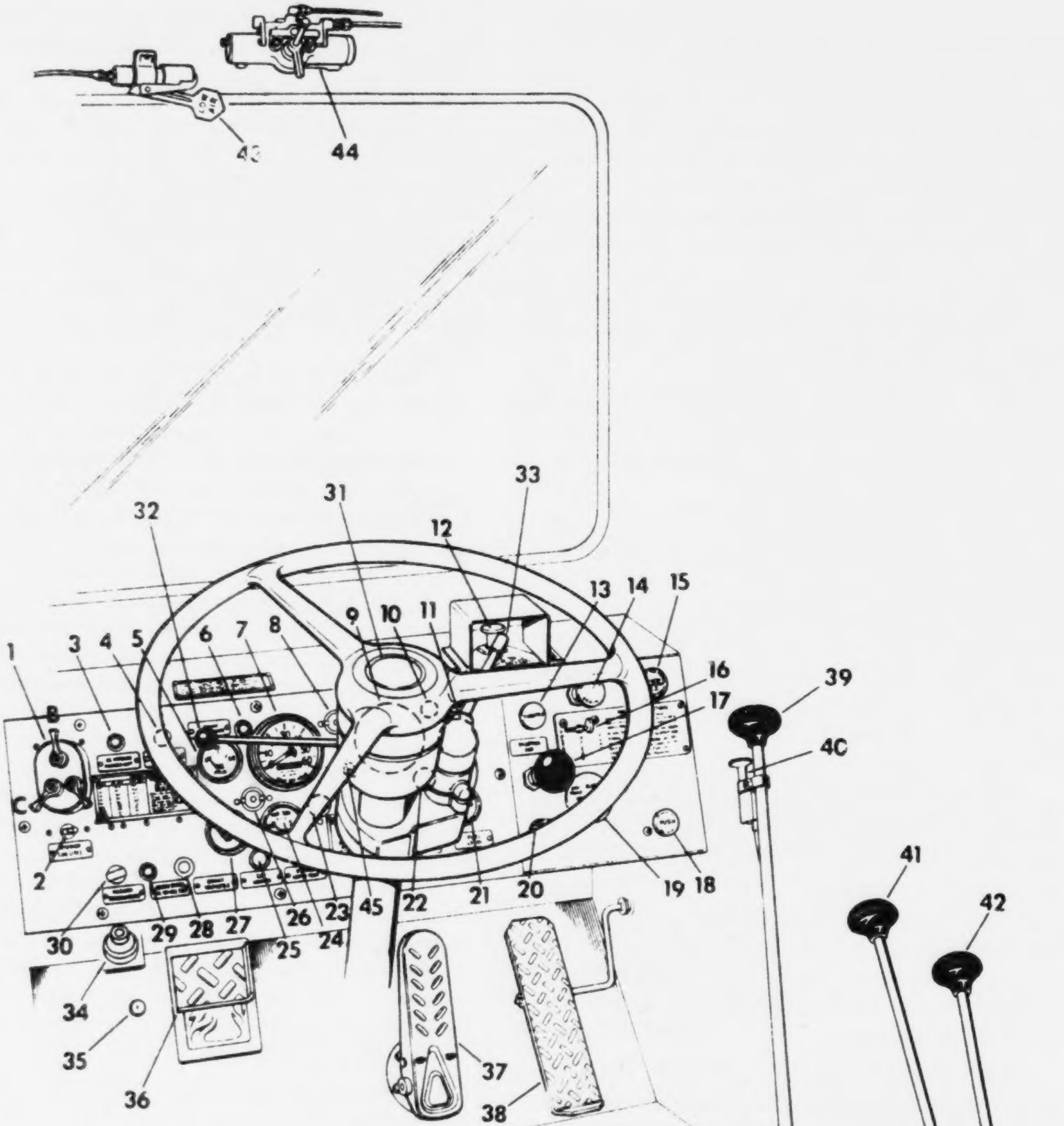
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Figure 6-1. Carrier instruments and controls.

1. Master light switch
2. Cab dome light switch
3. Oil temperature warning switch
4. Water temperature warning light
5. Engine oil pressure gauge
6. Left turn directional lamp
7. Speedometer/odometer
8. High beam indicator
9. Tachometer/hourmeter
10. Right turn directional lamp
11. Air pressure gauge
12. Park abort control
13. Engine throttle control
14. Reservoir drain valve
15. Tractor protection valve
16. Emergency—release—park lever
17. Starting aid
18. Interaxle differential lockout
19. Dry road—slippery road switch
20. Windshield wiper switch
21. Fuel level gauge
22. Panel lamp
23. Panel lamp
24. Water temperature gauge
25. Cab heater switch
26. Panel lamp
27. Battery-generator indicator
28. Ignition switch
29. Hazard warning switch light
30. Hazard warning switch
31. Horn button
32. Directional signal lever
33. Trailer brake lever
34. Windshield washer control
35. Headlight dimmer switch
36. Clutch pedal
37. Brake treadle valve
38. Accelerometer pedal
39. Main transmission shift lever
40. Transmission shift button
41. Transfer case control lever
42. Front axle control lever
43. Low air pressure indicator
44. Windshield wiper hand lever
45. Emergency switch

Figure 6-1. Carrier instruments and controls.

(3) Place the lever in the RELEASE position. The carrier brake system is now ready for normal operation.

d. Towing Another Vehicle. To tow, another vehicle, proceed as follows:

(1) Connect both the EMERGENCY and SERVICE BRAKE systems at the rear of the truck crane to the vehicle to be towed.

(2) Place lever (fig. 6-1, item 16) in the EMERGENCY position and run the engine until the carrier air pressure is at least 50 psi. It is recommended that the towed vehicle not be moved until it reaches normal system pressure. When the low air pressure flag rises, place the lever in the RELEASE position.

(3) Depress valve (15, fig. 6-1). The towed vehicle brakes will now operate when the carrier air brakes operate, and the carrier can be driven normally. The trailer brake lever (33, fig. 6-1) is used to apply the brakes on the towed vehicle only. Be careful to avoid too much speed on grades and use more caution than usual when towing another vehicle.

6-9. Front Axle Drive

a. General. The use of the driving front axle should be restricted to off highway or very rough or slippery conditions. When front axle drive is used, the operator should also consider engaging the interaxle differential lockout, as well as the SLIPPERY ROAD position of item 19, figure 6-1.

b. Engaging Front Axle Drive. To engage the front axle drive, proceed as follows:

(1) Stop the vehicle completely.

(2) Shift the transfer case into the LOW position.

(3) Shift the front axle control lever (41, fig. 6-1) into the IN position.

(4) Shift the main transmission lever to the desired starting position and bring the carrier up to operating speed in the usual manner.

c. Disengaging Front Axle Drive. Disengage front axle drive as follows:

(1) Stop the carrier.

(2) Shift the transfer case into the HIGH range.

(3) Shift the front axle control lever to the OUT position.

(4) Bring the carrier up to speed, using the main transmission shift lever.

Section IV. OPERATION UNDER USUAL CONDITIONS

6-10. General

a. The instructions in this section are published for the information and guidance of personnel responsible for operation of the Model M320T truck crane carrier.

b. The operator must be thoroughly familiar with the use of the controls of Model M320T truck crane carrier. This section gives instructions on starting and stopping the carrier, operation of the carrier, and on coordinating the basic motions required to perform the specific operations for which the equipment is designed.

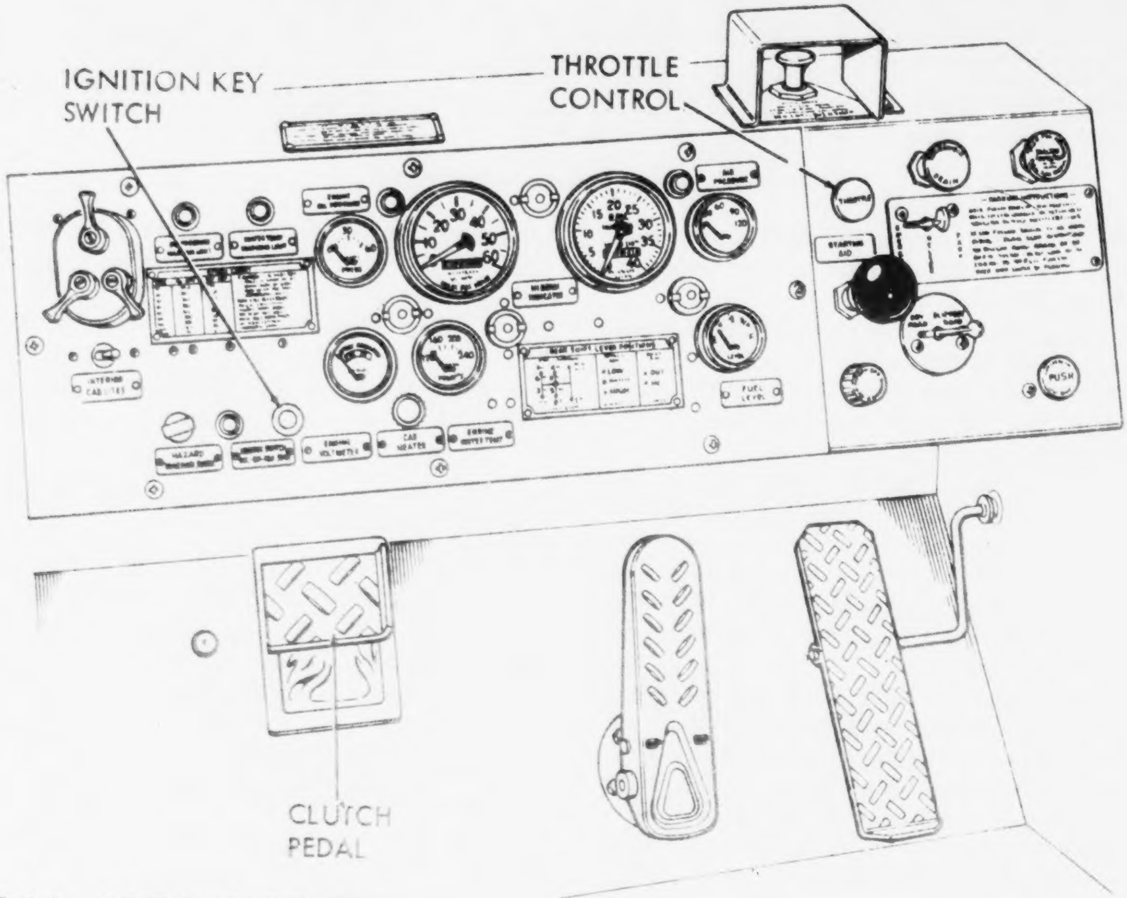
6-11. Starting

a. Preparation for Starting.

(1) Perform the pre-operation services (para 2-1).

(2) Lubricate the carrier as specified in (LO 5-3810-288-12.

b. Starting. Refer to figure 6-2 and start the carrier.



STEP 1. DEPRESS CLUTCH PEDAL.
STEP 2. TURN IGNITION KEY SWITCH TO START POSITION. WHEN ENGINE STARTS, RELEASE AND ALLOW KEY TO RETURN TO ON POSITION.
STEP 3. PULL OUT THE THROTTLE CONTROL AS NECESSARY TO MAINTAIN ENGINE IDLE SPEED AS THE ENGINE WARMS UP.
STEP 4. CHECK FOR WARNING LIGHT OR ABNORMAL GAUGE INDICATIONS.

CAUTION: DO NOT CRANK ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY WITHOUT ALLOWING A 2-MINUTE COOLING PERIOD. IF ENGINE DOES NOT START AFTER A FEW TRIES, STOP CRANKING. DETERMINE CAUSE AND CORRECT OR REPORT CONDITION TO ORGANIZATIONAL MAINTENANCE.

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Figure 6-2. Starting the engine.

STEP 1. DEPRESS CLUTCH PEDAL.
STEP 2. DEPRESS THROTTLE CONTROL TO CLOSE THROTTLE.
STEP 3. TURN IGNITION SWITCH TO OFF POSITION.
STEP 4. RELEASE CLUTCH PEDAL.

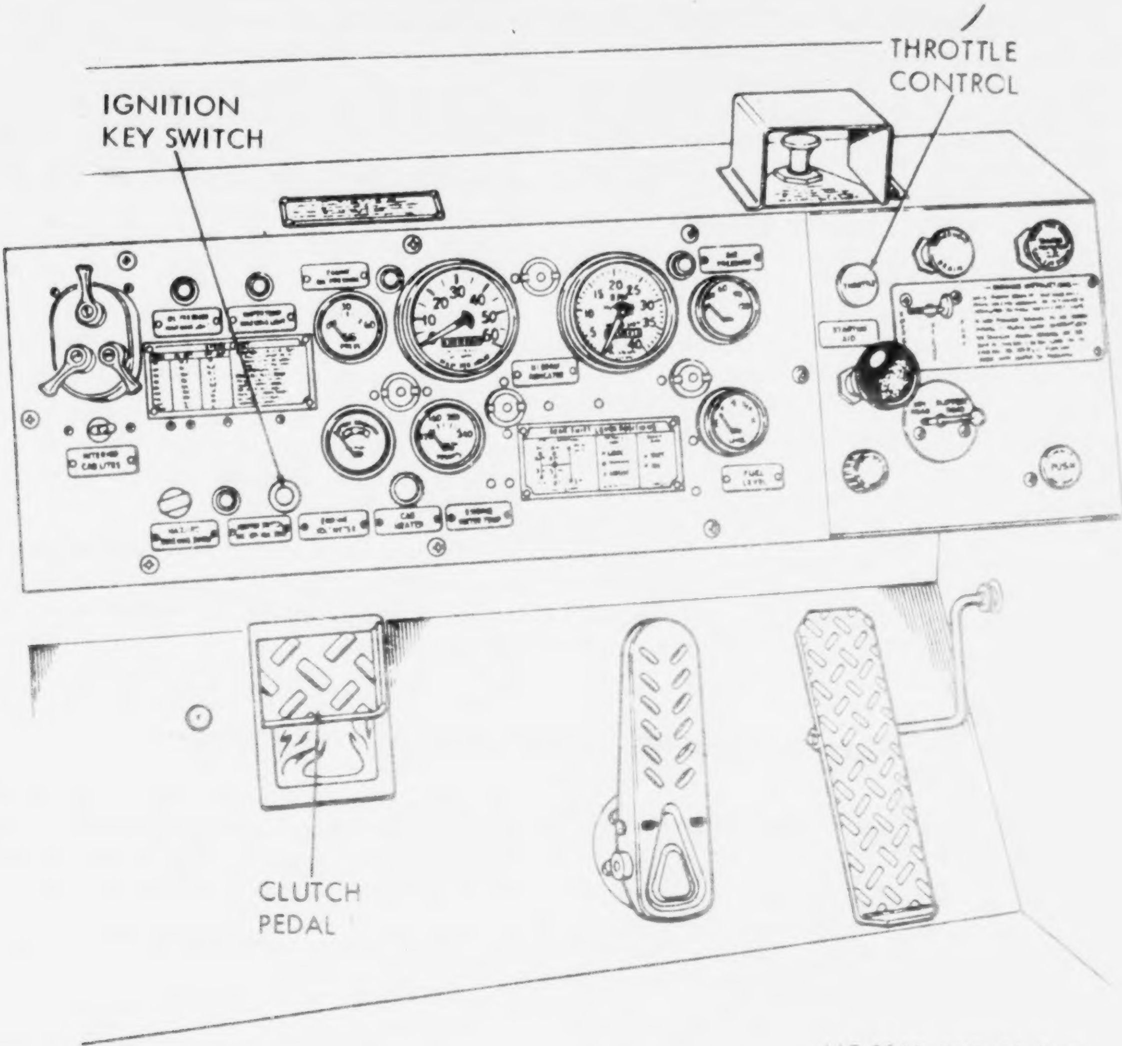
THROTTLE CONTROL
IGNITION KEY SWITCH
CLUTCH PEDAL

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Figure 6-3. Stopping the engine.

c. Engine Warmup. Start the engine and bring it to a fast idle (approx 1,500 rpm) until normal operating temperature is reached, and the oil pressure gauge shows operating readings.

(1) In cold weather, warmup time can be reduced by keeping the engine radiator covered.

(2) Watch the engine oil pressure gauge closely. If the gauge does not indicate oil pressure within 15 seconds after starting the engine, stop the engine and report this condition to organizational maintenance.

6–12. Stopping the Engine

Refer to figure 6–3 and stop the engine.

6–13. Operating the Carrier

a. Start the engine (para 6–11).

b. Place the transfer case lever in the neutral position, and release the clutch pedal.

c. Place the EMERGENCY-RELEASE-PARK lever in the EMERGENCY position, and operate the engine at a fast idle (approx. 1,500 rpm) until the low air pressure warning flag retracts.

d. Depress the clutch pedal, and place the transfer case lever in the proper position (low or high range) as indicated on the gearshift nameplate. Make certain that the transmission shift button is depressed for operation in the low range.

***Warning:* Do not operate unit on longitudinal slopes exceeding 30 per cent.**

***Caution:* Do not shift the transfer case while the carrier is in motion.**

e. Release the clutch pedal to engage the clutch, while depressing the accelerator to increase the engine output, and drive off.

f. To shift the main transmission to the next higher gear, depress the clutch pedal, place the main transmission lever in the position indicated on the gear shift position nameplate, and release the clutch pedal. To shift into the main transmission high range, lift the transmission shift button.

g. To retard the motion of the carrier, remove pressure from the accelerator pedal. To bring the carrier to a stop, depress the brake treadle valve.

h. To hold the carrier brakes applied for short-term parking, bring the carrier to a stop, and place the brake three-way control lever in the EMERGENCY position.

i. To hold the carrier brakes applied for long-term parking, bring the carrier to a stop, and place the brake three-way control lever in the PARK position.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

6–14. Operation in Extreme Cold (Below 0° F)

a. General. Operation in extreme cold presents special problems due to the increased possibility of condensation, and consequent freezing, and the increased difficulty of keeping parts lubricated adequately.

***Warning:* Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful injury may result.**

b. Lubrication. See instructions in paragraph 2–26*b*.

c. Cooling System. See instructions in paragraph 2–26*c*.

d. Batteries. See instructions in paragraph 2–26*d*.

e. Fuel System. Keep the fuel tank as full as possible at all times to minimize condensation. If the presence of water is noted in the fuel supply, drain the tank and refill it with clean fuel.

f. Starting. See paragraph 2–26*f*.

g. Warmup.

(1) Cover part of the air passages through the radiator, to aid warmup and to maintain engine running temperature. During warmup only, the entire radiator may be covered.

(2) Place the transfer case shift lever in the neutral position, select a gear on the main transmission, and release the clutch pedal to turn over and warmup the main transmission.

h. Stopping. The park abort feature must be used in extremely cold weather to prevent the brakes from freezing up. Refer to paragraph 6–8.

6-15. Operation in Extreme Heat

See paragraph 3-27.

6-16. Operation in Dusty or Sandy Areas

a. General. Operation in dusty or sandy areas presents special problems due to abrasive action of dust which shortens the life of parts. Make every effort to keep dust and sand out of the engine, transmissions, and axles.

b. Lubrication. All lubricants and lubricating equipment must be kept clean. Service breathers and air cleaners frequently to remove sand and dust. Lubricate the entire carrier more frequently to keep a supply of clean lubricant at moving parts. Clean all lubrication fittings thoroughly before attaching the grease gun.

c. Fuel System. See paragraph 2-28*f*.

6-17. Operation in High Humidity or Salt-Water Areas

See paragraph 2-29.

6-18. Operation at High Altitudes

See paragraph 2-30.

CHAPTER 7

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR'S AND ORGANIZATIONAL MAINTENANCE REPAIR PARTS, TOOLS, AND EQUIPMENT

7-1. Tools and Equipment

a. Basic issue tools and repair parts issued with or authorized for the Model M320T Truck Crane are listed in the Basic Issue Items List, Appendix B of this manual.

b. No special tools or equipment are required by the operator or organizational maintenance personnel for maintenance of the Model M320T Truck Crane.

Section II. LUBRICATION

7-2. General Lubrication Information

For general lubrication instructions see paragraph 3-2.

Figure 7-1. Lubrication chart. (Not used) See LO 5-3810-288-12.

7-3. Detailed Lubrication Information

For detailed lubrication instructions see paragraph 3-3 and LO 5-3810-288-12.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

7-4. General

To insure that the Model M320T Truck Crane is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed and described in paragraph 7-5. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 at the earliest possible opportunity.

7-5. Preventive Maintenance Checks and Services

See table 7-1 for a tabulated listing of preventive maintenance checks and services.

Table 7-1. Preventive Maintenance Checks and Services

Item Number	Interval						B—Before operation D—During operation	A—After operation W—Weekly	M—Monthly Q—Quarterly
	Operator					Org.			
	Daily				M	Q	Item to be inspected	Procedure	Reference
	B	D	A	W					
1.								Lubricate in accordance with the lubrication chart	
2.	X		X				Fuel supply	Keep tank full	figure 7-10
3.				X			Fuel sediment bowl	Clean	figure 7-6
4.	X		X				Radiator	Fill ¾ inch above baffle plate	figure 7-2
5.	X		X				Engine oil dipstick	Add oil as indicated	
6.				X			Drive belts	Adjust as required	figure 7-31, and figure 7-34
7.				X			Oildex filter	Inspect and clean glass cup when ⅓ full	figure 3-28
8.				X			Batteries	Check electrolyte level and tightness of connections. Fill to ⅜ inch (approx.) above the plates. In freezing weather, run the engine for one hour after adding water	figure 3-59
9.				X			Engine oil filter	Change filter element	figure 7-23
10.	X						Fire extinguisher	Check for broken seal	para 7-60
11.				X			Hydraulic steering reservoir	Check level and add oil if necessary	figure 7-35
12.	X						Controls	With the unit running, operate each control. See that the control functions properly.	figure 6-1
13.	X	X					Gages and instruments Coolant temperature Engine oil pressure Voltmeter Tachometer	Normal readings are: 160 to 200 F. 35 to 45 psi See figure 2-37. 2600 rpm (maximum) See para 1-4	figure 6-1
14.				X			Air cleaner	Check cup, clean if necessary	figure 7-9
15.				X			Air reservoir	Drain air pressure and drain water and sediment	figure 7-44
16.	X						Tire and pressure	Check pressure. Tire pressure should be 75 psi	figure 7-39
17.						X	Fuel supply	Keep tank full. Inspect fuel lines for leaks and tighten connections if necessary.	figure 7-10
18.						X	Fuel sediment bowl	Clean. Check for leaks and tighten connections if necessary.	figure 7-6
19.						X	Radiator	Fill to ¾ inch above baffle plate. Replace cracked or damaged hose. Tighten all mounting clamps and connections. The correct cap pressure rating is from 7 to 13 psi.	figure 7-2
20.						X	Crankcase oil	Add oil as indicated. Refer to the lubrication chart.	
21.						X	Engine drive belts	Adjust as required. Replace worn or frayed belts.	figure 7-31, 7-32, and figure 7-34

22.					X		Oildex filter	Clean glass cup when ½ full. Monthly or every 200 operating hours replace filter. Quarterly, disassemble and clean entire unit.	figure 3–28
23.						X	Batteries	Check electrolyte level and tightness of connections. Fill to ⅜ inch (approx.) above the plates. In freezing weather. run the engine for one hour after adding water. Clean vent hole in filler caps before installing caps. Replace a cracked or leaking battery.	figure 3–59
24.					X	X	Transmission air filter	Monthly, remove drain plug and blow out accumulated sediment. Quarterly, or each 400 operating hours, replace the filter.	figure 7–11
25.						X	Engine oil filter	Change filter elements and replace filter cover gaskets. Check for leaks and repair or replace external connections if necessary.	figure 7–23
26.						X	Hydraulic steering reservoir	Check level and add oil if necessary. Every six months remove reservoir, clean filter, and replace oil.	figure 7–35
27.						X	Service brakes	Remove wheel. Inspect brake lining and replace brake shoes if lining is within 1/16 inch of rivets.	figure 7–39 and figure 7–48
28.						X	Engine clutch	Adjust if necessary.	figure 7–56

Section IV. OPERATOR'S MAINTENANCE

7–6. General

Instructions in this section are published for the information and guidance of the operator in maintaining the carrier of the Model M320T Truck Crane.

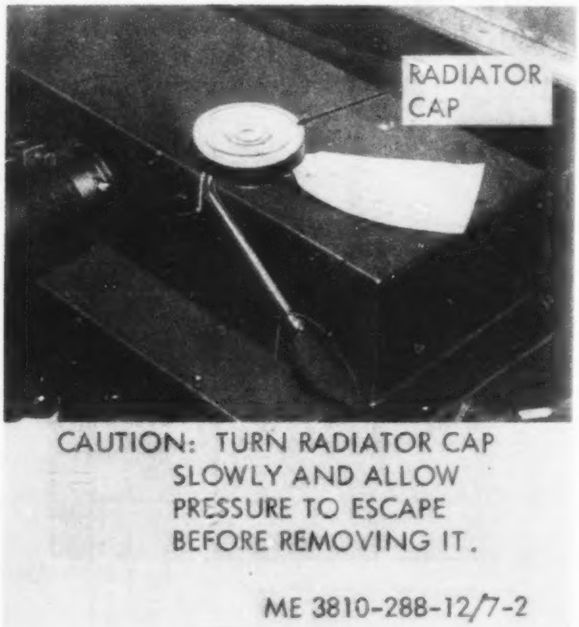
7–7. Engine Inspection

Visually inspect the engine and engine accessories for fluid leaks or any other physical damage which would make it unsafe to start or run the engine.

7–8. Radiator Service

Figure 7–2 illustrates the radiator in the carrier of the machine. The carrier radiator is serviced in the same manner as the upper radiator. Refer to paragraph 3–8 and service the carrier radiator.

Caution: Turn radiator cap slowly and allow pressure to escape before removing it.



CAUTION: TURN RADIATOR CAP SLOWLY AND ALLOW PRESSURE TO ESCAPE BEFORE REMOVING IT.

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Figure 7–2. Radiator service.

7–9. Fan Inspection

Refer to figure 7–3 and inspect the fan for bent or otherwise damaged blades, loose mounting bolts, misalignment, or an unbalanced condition.

7–10. Air Compressor Inspection and Service

a. Inspection. Refer to figure 7–4 and inspect the air intake and discharge hoses, oil line, and cooling water lines for leaks, kinks, worn areas, or pinches. Inspect the air compressor mounting bolts to be sure they are tight. Inspect the drive belts to be sure they are properly alined and the belt tension is correct.

b. Service. Since the air compressor air intake is connected to the carrier air cleaner, and the compressor is lubricated and cooled by carrier engine oil and water, the only servicing necessary is keeping the air cleaner clean and the fluid levels in the engine and radiator properly maintained. Refer to paragraphs 7–14, 7–42 and 7–8.

7–11. Hydraulic Pump Reservoir Service

Refer to figure 7–5 and service the hydraulic pump reservoir.

7–12. Fuel Filter Service

a. General. There are two fuel filters on the carrier of this machine. One is located on the left side of the engine and is of the sediment bowl type. The other is an integral part of the carrier fuel pump which is located on the right side of the carrier in front of the fuel tank.

b. Sediment Bowl Service. Figure 7–6 illustrates the location of the sediment bowl. The carrier sediment bowl is serviced in the same manner as the upper sediment bowl. Refer to figure 7–6 and service the carrier sediment bowl.

c. Fuel Pump Filter Service. The fuel pump filter should be serviced when the sediment bowl is serviced. Refer to figure 7–7 and service the fuel pump filter.

7–13. Battery Inspection and Service

Figure 7–8 illustrates the batteries in the carrier of the machine. The inspection and service of the carrier batteries is identical to that of the upper batteries. Refer to paragraph 3–7 and inspect and service the carrier batteries.

7–14. Air Cleaner Service

Figure 7–9 illustrates the location of the carrier air cleaner. The carrier air cleaner is serviced in the same manner as the upper air cleaner. Refer

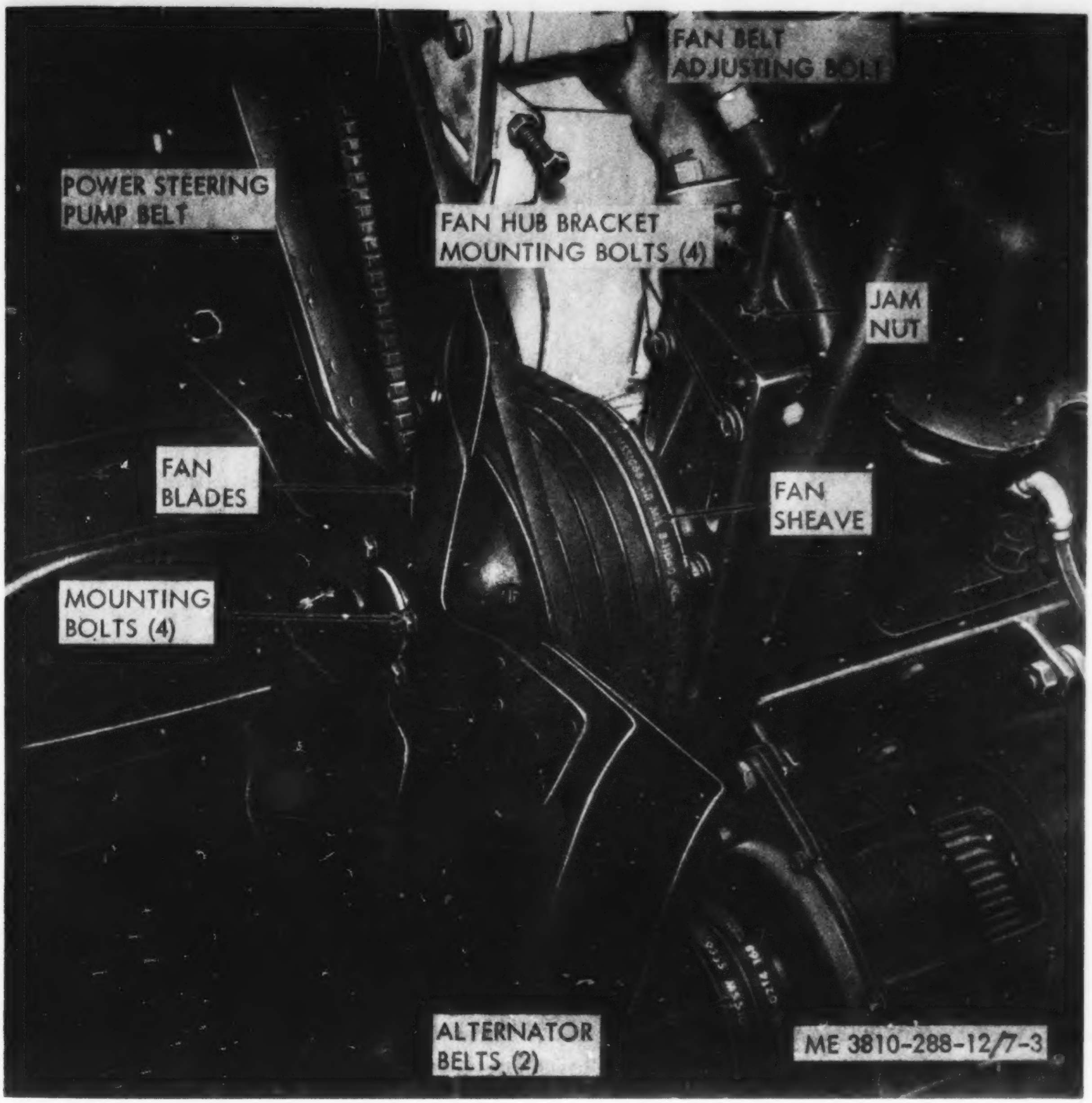

FAN BELT ADJUSTING BOLT
POWER STEERING PUMP BELT
FAN HUB BRACKET MOUNTING BOLTS (4)
JAM NUT
FAN BLADES
FAN SHEAVE
MOUNTING BOLTS (4)
ALTERNATOR BELTS (2)
ME 3810-288-12/7-3

Figure 7-3. Fan inspection.

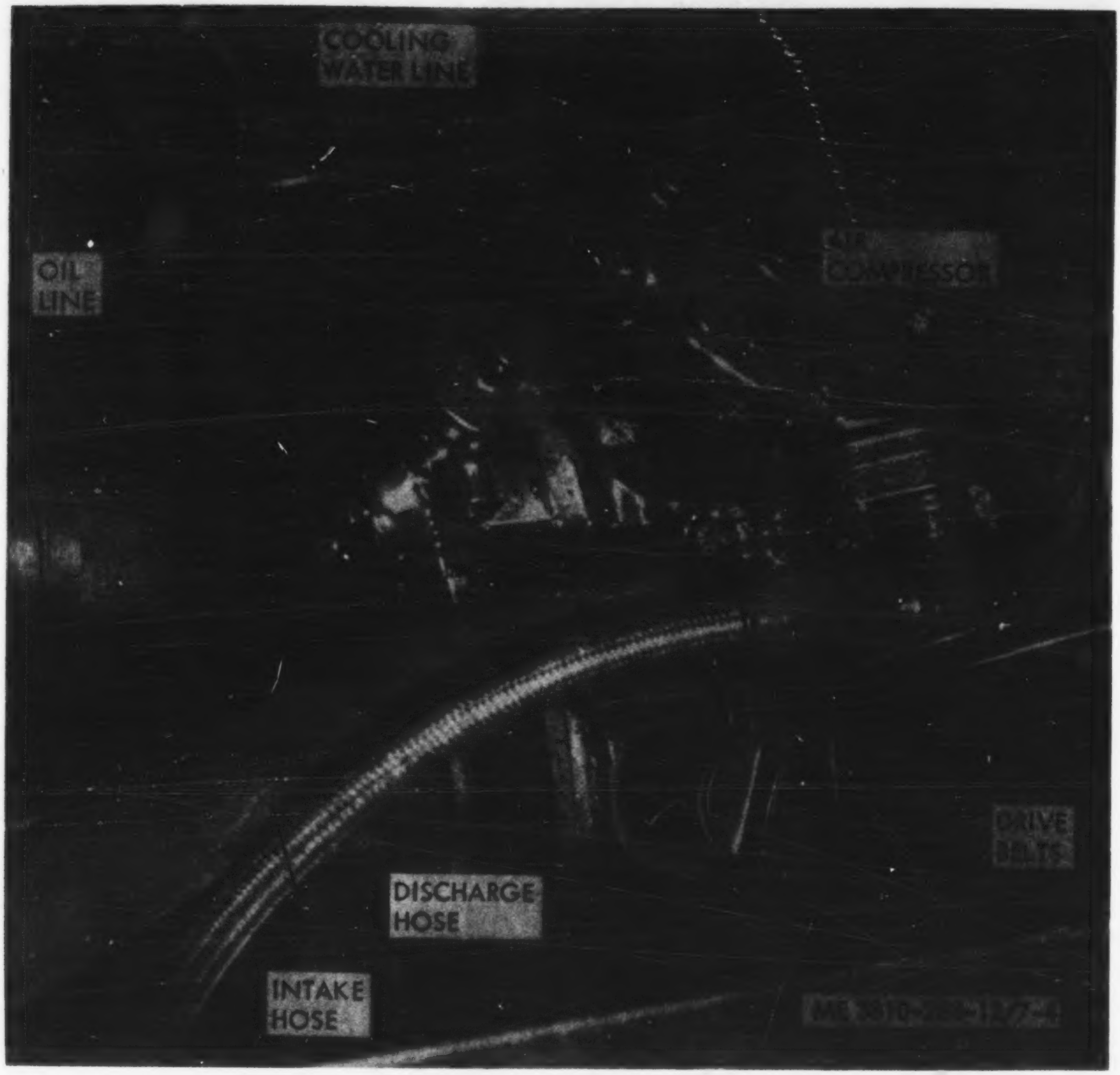
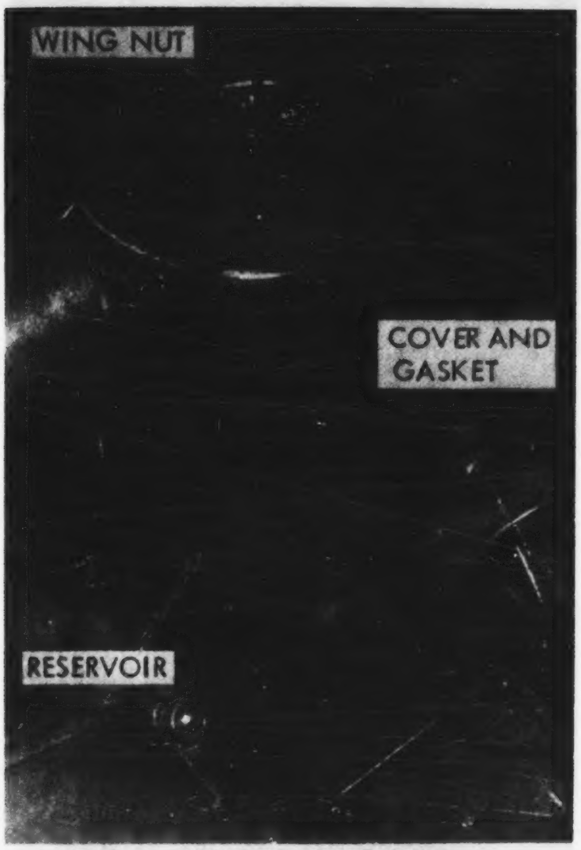

COOLING WATER LINE
OIL LINE
AIR COMPRESSOR
DRIVE BELTS
DISCHARGE HOSE
INTAKE HOSE
ME 3810-288-12/7-4

Figure 7-4. Air compressor inspection.



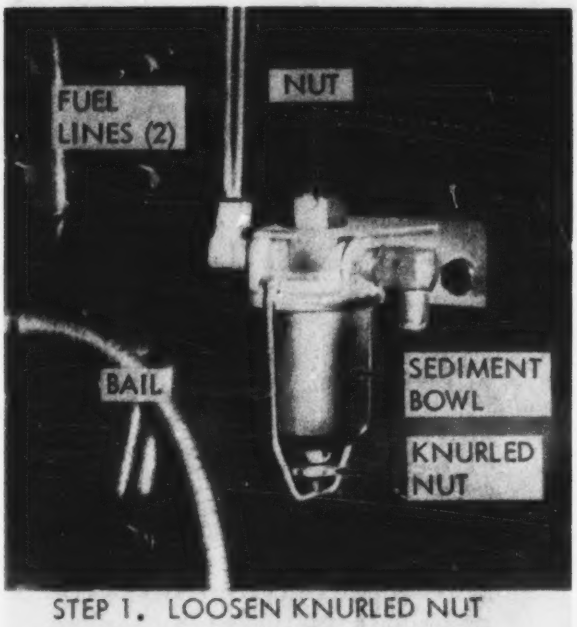
STEP 1. REMOVE WING NUT, COVER, AND GASKET.

STEP 2. CHECK THAT OIL LEVEL IS WITHIN 1/2 INCH OF RESERVOIR RIM. IF OIL LEVEL IS BELOW THIS LEVEL, REPORT TO PROPER AUTHORITY.

STEP 3. REPLACE GASKET, COVER, AND WING NUT.

ME 3810-288-12/7-5

Figure 7-5. Hydraulic pump reservoir service.



STEP 1. LOOSEN KNURLED NUT AND SWING BAIL ASIDE. REMOVE SEDIMENT BOWL AND GASKET. CLEAN SEDIMENT BOWL WITH CLEAN CLOTH.

STEP 2. INSTALL GASKET AND SEDIMENT BOWL. SWING BAIL UNDER SEDIMENT BOWL AND TIGHTEN KNURLED NUT.

ME 3810-288-12/7-6

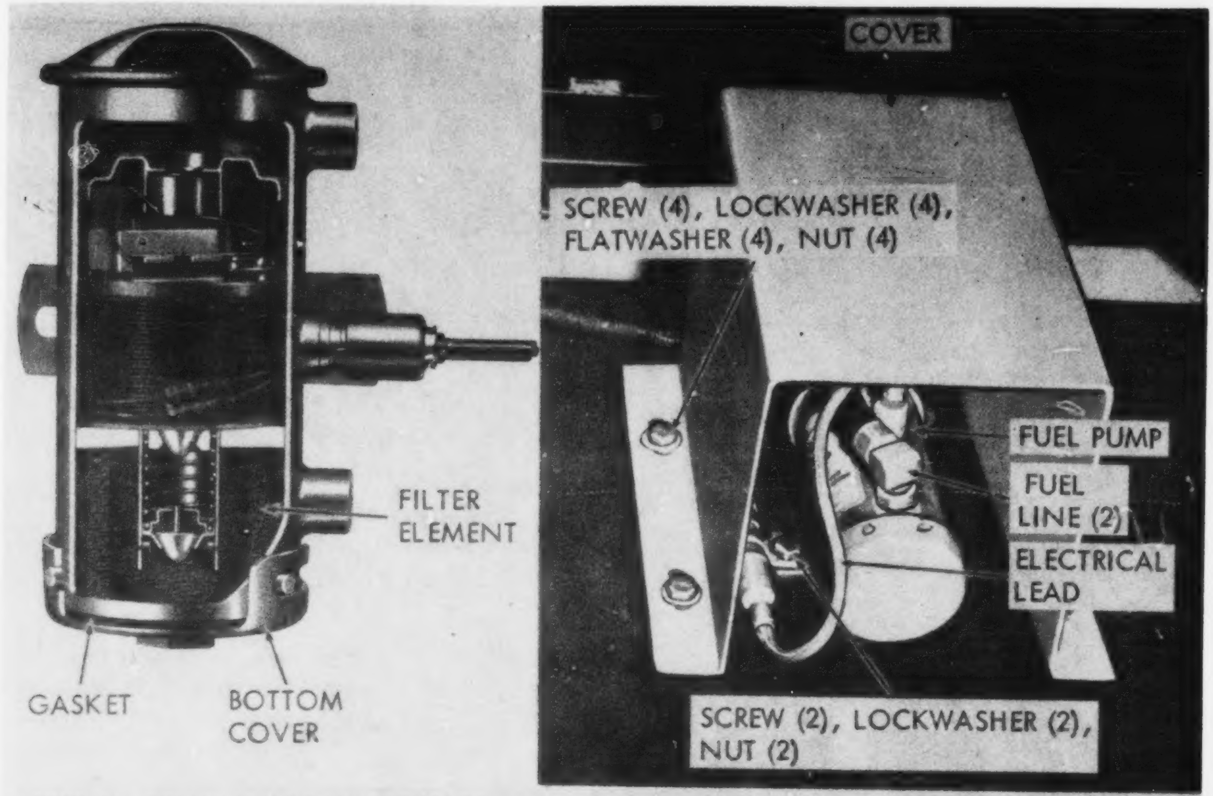
Figure 7-6. Sediment bowl service, removal and replacement.

to paragraph 3-9 and service the carrier air cleaner.

7-15. Fuel Tank Service

The fuel tank should be kept as full as possible at all times to minimize condensation. Keep the fuel tank filler cap tight to prevent the entry of foreign material into the tank. Refer to figure 7-10 to fill the fuel tank. If water or other contamination is detected in the gasoline, refer to figure 7-10 and drain the fuel tank.

Warning: **When refueling the Model M320T Truck Crane, always provide a metal to metal contact between the filler nozzle and the gasoline tank. This will prevent sparks which might ignite**


COVER
SCREW (4), LOCKWASHER (4), FLATWASHER (4), NUT (4)
FUEL PUMP
FUEL LINE (2)
ELECTRICAL LEAD
FILTER ELEMENT
GASKET
BOTTOM COVER
SCREW (2), LOCKWASHER (2), NUT (2)

STEP 1. REMOVE BOTTOM COVER, GASKET, AND FILTER ELEMENT. WASH FILTER ELEMENT IN CLEANING SOLVENT AND BLOW OUT WITH COMPRESSED AIR.

STEP 2. INSTALL GASKET IN BOTTOM COVER. INSTALL FILTER ELEMENT IN FUEL PUMP AND INSTALL BOTTOM COVER.

ME 3810-288-12/7-7

Figure 7-7. Fuel pump filter service, and fuel pump removal and replacement.

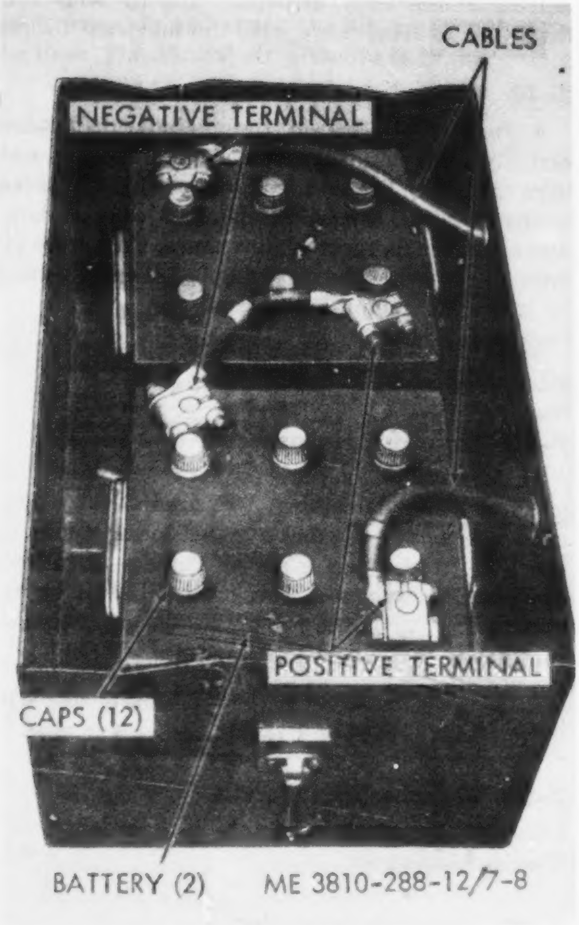

CABLES
NEGATIVE TERMINAL
POSITIVE TERMINAL
CAPS (12)
BATTERY (2)
ME 3810-288-12/7-8

Figure 7-8. Battery inspection and service.

fuel, and will thus prevent an unsafe condition which might destroy the machine or injure personnel.

7-16. Air Filter Service

Refer to figure 7-11 and service the air filter located on the left side of the main transmission.

7-17. Front Axle Inspection

Inspect the front axle for grease or oil leaks or any other damage. A wet area usually indicates a leak, and should be traced to the source of the leak. Report all leaks and damage to Direct Support Maintenance.

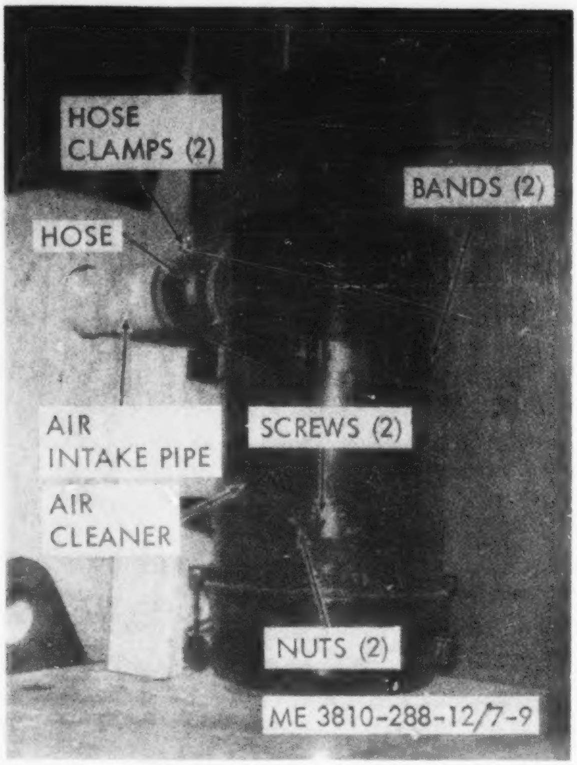
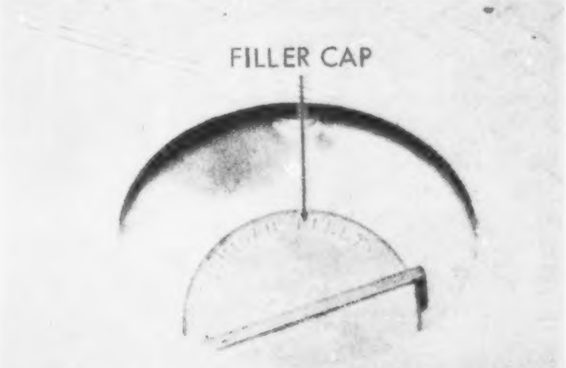

HOSE CLAMPS (2)
BANDS (2)
HOSE
AIR INTAKE PIPE
SCREWS (2)
AIR CLEANER
NUTS (2)
ME 3810-288-12/7-9

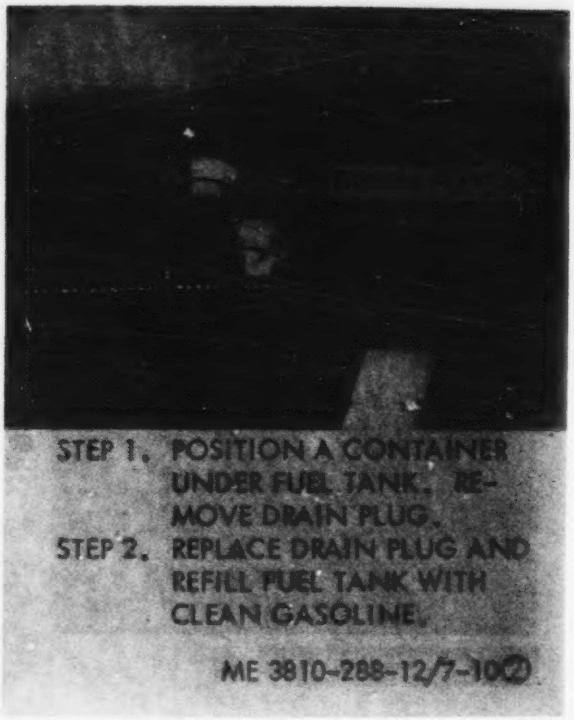
Figure 7-9. Air cleaner service.


FILLER CAP

STEP 1. REMOVE FILLER CAP.
STEP 2. FILL TANK WITH GASOLINE. TANK CAPACITY IS 75 GALLONS.
STEP 3. REPLACE FILLER CAP.

ME 3810-288-12/7-10①

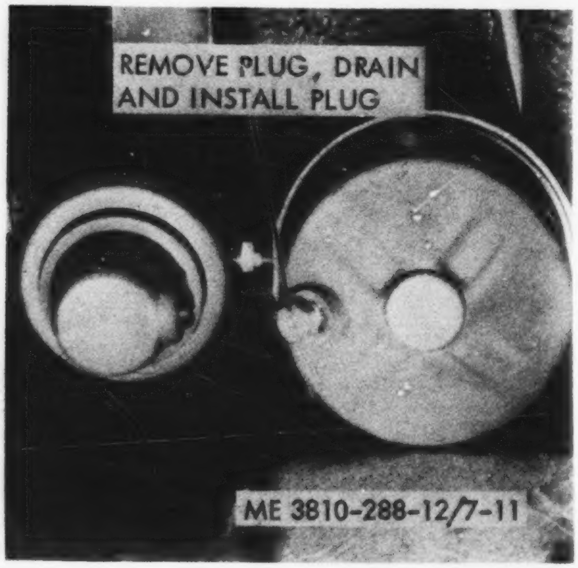
Figure 7-10. Fuel tank service. (Sheet 1 of 2)



STEP 1. POSITION A CONTAINER UNDER FUEL TANK. REMOVE DRAIN PLUG.

STEP 2. REPLACE DRAIN PLUG AND REFILL FUEL TANK WITH CLEAN GASOLINE.

Figure 7-10. Fuel tank service. (Sheet 2 of 2)



REMOVE PLUG, DRAIN AND INSTALL PLUG

Figure 7-11. Air filter service, removal, and replacement.

7–18. Tie Rod and Drag Link Service

Clean the area around the tie rod and drag link ends to prevent the entry of dirt into the tie rod and drag link ends. Lubricate the tie rods and drag link in accordance with the lubricant order.

7–19. Transmission Inspection and Service

a. Inspection. Inspect the main transmission and drop box for leaks or other damage. A wet area usually indicates a leak, and should be traced to the source of the leak. Report all leaks or damage to Direct Support Maintenance. Check the oil level by removing the oil level plug. The oil should be just up to the oil level opening.

b. Service. Add oil of the type listed in the lubrication order as required.

7–20. Transfer Case Inspection and Service

a. Inspection. Inspect the transfer case for leaks or other damage. A wet area usually indicates a leak, and should be traced to the source of the leak. Report all leaks or damage to Direct Support Maintenance. Check the oil level by removing the cap on the standpipe. The oil should be just below the end of the standpipe.

b. Service. Add oil as necessary, of the type listed in the lubrication order.

7–21. Propeller Shaft Service

Lubricate the universal joints in accordance with the lubricant order.

7–22. Rear Axle Inspection

The inspection of the rear axles is the same as the front axle. Refer to paragraph 7–17 and inspect the rear axles.

7–23. Differential Inspection

Inspect the area around the front and rear differentials for oil leaks and damage. Report all leaks and damage to General Support Maintenance. Check the oil levels by removing the oil level plug. The oil level should be just up to the oil level opening. Report low oil level to Organizational Maintenance.

7–24. Wheel Inspection

Inspect the wheels for broken welds, bent or distorted beads, and loose wheel nuts. Report any deficiency to Organizational Maintenance.

7-25. Tire Inspection and Service

a. Inspection. Inspect all the tires in accordance with TM 9-1870-1.

b. Service. Remove any sharp objects wedged in the tire treads and check the air pressure in all the tires. The normal air pressure is 75 psi.

7-26. Outrigger Service

Refer to figure 7-12 and clean all rust and corrosion from the outrigger boxes, jackscrews, and jack floats. Paint the outrigger boxes and jack floats in accordance with TM 9-213. Lubricate the jackscrews with the lubricant listed in the lubrication order according to the interval also listed.

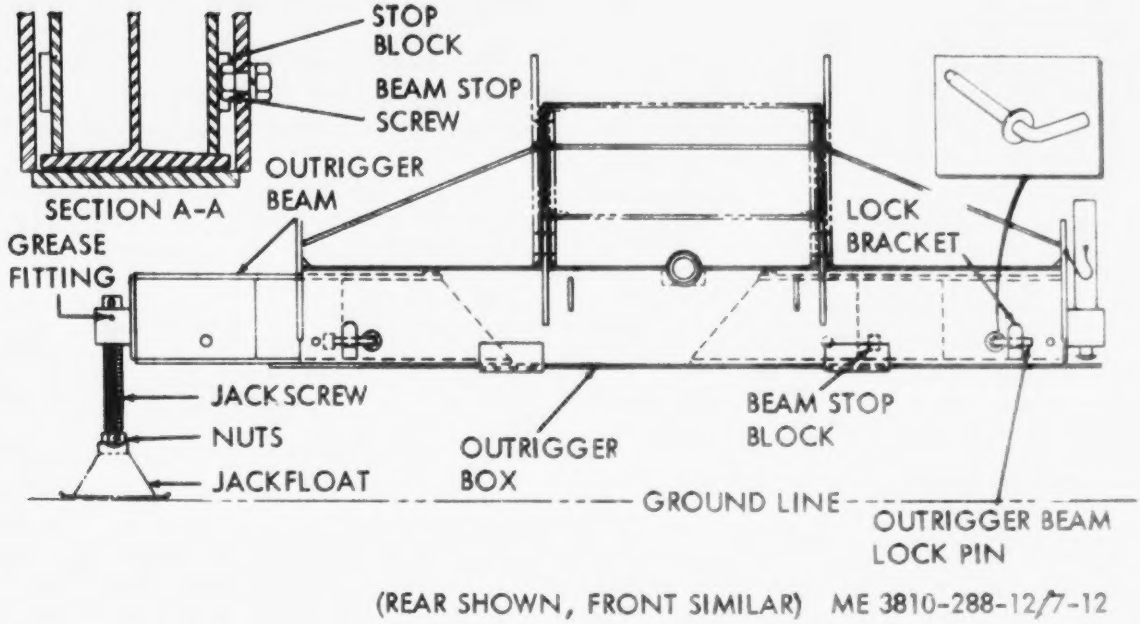

STOP BLOCK
BEAM STOP SCREW
OUTRIGGER BEAM
SECTION A-A
GREASE FITTING
LOCK BRACKET
JACKSCREW
NUTS
JACKFLOAT
OUTRIGGER BOX
BEAM STOP BLOCK
GROUND LINE
OUTRIGGER BEAM LOCK PIN
(REAR SHOWN, FRONT SIMILAR) ME 3810-288-12/7-12

Figure 7-12. Outrigger service.

7-27. Pintle Hook Service

Remove all rust and corrosion from the pintle hook and paint it in accordance with TM 9-213. Lubricate the hinge pin with the lubricant listed in the lubrication order, according to the interval also listed.

7-28. Air Brake Hose and Fitting Inspection

Inspect all air brake hoses and pipes for leaks, kinks, worn areas, and brakes. Apply a solution of soapy water to all fittings and connectors of the air brake system and observe for leaks.

7-29. Lights

The inspection of the carrier lights is the same as the upper lights. Refer to paragraph 3-16 and inspect the lights on the carrier.

7-30. Horn

The inspection of the carrier horn is the same as the upper horn. Refer to paragraph 3-17 and inspect the horn on the carrier.

7-31. Gear Shift Control Service

The servicing of the gear shift controls consists of checking the nuts and bolts on the gear shift control linkage to be sure that they are tight, and to lubricate the linkage pivots not equipped with grease fittings with OE.

7-32. Speedometer and Tachometer Drive Service

Check the tightness of the knurled nuts at each end of the speedometer and tachometer drive cables and tighten if necessary. Clean the end of the drive cables to prevent dirt from entering the cable housing.

7-33. Data Plate Inspection

Inspect all data plates for readability, loose screws and nuts, or other physical damage. Report any deficiency to Organizational Maintenance.

7-34. Fire Extinguisher Service

Service the carrier fire extinguisher in the same manner as the upper fire extinguisher. Refer to paragraph 3-32 and service the carrier fire extinguisher.

Section V. TROUBLESHOOTING

7-35. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the Model M320T Truck Crane and its components. Malfunctions which may occur are listed in table 7-2. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

7-36. Troubleshooting

See table 7-2 for a tabulated listing of possible troubles, probable causes, and possible remedies.

Table 7-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine will not crank.	*a.* Batteries discharged or cables loose or corroded.	*a.* Replace batteries (para 7-41) or clean and tighten cables (para 7-41).
	b. Faulty starter solenoid.	*b.* Replace starter solenoid (para 7-41).
2. Engine will not start.	*a.* Out of fuel.	*a.* Fill fuel tank (para 7-15).
	b. Restricted air intake.	*b.* Service air cleaner (para 7-14).
	c. Improper ignition.	*c.* Service distributor (para 7-41).
	d. Improper valve clearance.	*d.* Adjust valves (para 7-50).
	e. Defective battaries.	*e.* Replace or recharge battaries (para 3-49j)
	f. Low temperature.	*f.* Use cold weather starting aid (para 7-14f)
3. Engine overheats.	*a.* Radiator coolant level low.	*a.* Add coolant (para 7-8).
	b. Engine oil level low.	*b.* Add oil (para 7-42).
	c. Water pump V-belt loose.	*c.* Adjust belt (para 7-41).
	d. Water pump faulty.	*d.* Replace water pump (para 7-43).
	e. Collapsed hoses or loose connection	*e.* Check condition of coolant hose, and tighten loose connection.
	f. Defective thermostat.	*f.* Replace thermostat (para 7-42d)
4. Low oil pressure.	*a.* Oil too light or diluted.	*a.* Drain crankcase and refill with correct oil. Refer to current LO.
	b. Oil level low.	*b.* Add oil (para 7-42).
	c. Oil filter clogged.	*c.* Change oil filters (para 7-42).
	d. Faulty oil temperature sender or gauge.	*d.* Replace gauge or sender (para 7-42).

Table 7-2. Troubleshooting—Continued

Malfunction	Probable cause	Corrective action
5. Batteries discharge with engine running.	*a.* Faulty atlernator. *b.* Alternator V-belt loose. *c.* Alternator brushes worn. *d.* Loose connections.	*a.* Repair or replace alternator (para 7-41). *b.* Adjust V-belt tension (para 7-41). *c.* Replace alternator (para 7-41). *d.* Inspect wiring and tighten loose connections.
6. Excessive oil consumption.	*a.* Oil leaks. *b.* Poor quality or wrong grade oil for weather.	*a.* Check oil lines and tighten loose lines. *b.* Refer to lubrication chart.
7. Incorrect air brake system pressure	*a.* Leaks in system. *b.* Governor set at wrong pressure range.	*a.* Replace defective compressor. *b.* Adjust governor (para 7-46).
8. Engine tends to stall at full load	*a.* Faulty fuel pump or dirty fuel pump filter. *b.* Dirty sediment bowl. *c.* Dirty air cleaner. *d.* Low compression	*a.* Repair or replace fuel pump (para 7-40). *b.* Clean sediment bowl (para 7-12). *c.* Clean air cleaner (para 7-14). *d.* Check compression (para 7-49).
9. Power steering is "spongy" and makes "groaning" sound	*a.* Low fluid level. *b.* Mechanical linkage binds.	*a.* Add power steering fluid (para 7-44). *b.* Refer to higher authority.
10. Engine noisy	Tappet clearance excessive.	Adjust tappets (para 7-50).
11. Engine clutch overheats or jumps out of engagement.	*a.* Improper clutch adjustment. *b.* Clutch plates worn excessively.	*a.* Adjust clutch (para 7-51). *b.* Refer to Direct Support Maintenance.
12. Engine "cuts out" quite suddently under load	*a.* Restricted fuel line. *b.* Faulty fuel pump. *c.* Dirty fuel tank.	*a.* Replace line (para 7-40). *b.* Replace pump (para 7-40). *c.* Drain fuel tank (para 7-40).
13. Rough or erratic engine idling	*a.* Intake manifold leaks. *b.* Faulty carburetion. *c.* Dirty air cleaner.	*a.* Repair intake manifold (para 7-47). *b.* Repair or replace carburetor (para 7-40). *c.* Clean. (para 7-14).
14. Engine knocks	*a.* Low octane fuel. *b.* Connecting rod bearings or main bearings damaged.	*a.* Use correct fuel (para 3-13). *b.* Refer to Direct and General Support Maintenance.
15. Engine exhaust is smoky.	*a.* If exhaust is black, incomplete fuel combustion due to poor spark plugs or ignition timing. *b.* If exhaust is blue, the engine is burning oil due to leaking oil into exhaust manifold or blow-by past piston rings.	*a.* Replace spark plugs (para 7-41) and adjust ignition timing (para 7-41). *b.* Refer to Direct and General Support Maintenance.

Malfunction	Probable cause	Corrective action
16. Incorrect alternator voltage	Faulty alternator.	Replace alternator (para 7-41).
17. Hard steering (vehicle moving)	*a*. Reservoir too full. *b*. Filter clogged.	*a*. Remove fluid to full mark (para 7-11). *b*. Replace reservoir or clean filter (para 7-44).
18. Hard steering (vehicle standing still, or trouble intermittant)	*a*. Fluid level low. *b*. Pump belt loose or glazed. *c*. Tires worn, unbalanced wheels, wrong air pressure, or out of alignment.	*a*. Fill reservoir (para 7-11). *b*. Adjust belt (para 7-41) or replace belt (para 7-41). *c*. Check pressure (para 7-24). Report any other difficulty to Direct and General Support Maintenance.
19. Brakes "grab" or the vehicle tends to turn when brakes are applied	*a*. Improper brake adjustment. *b*. Worn brake linings.	*a*. Adjust brakes (para 7-46). *b*. Replace brake shoes (para 7-46).
20. Engine overspeeds	Incorrect speed governor adjustment.	Adjust speed governor (para 7-40).

Section VI. FIELD EXPEDIENT REPAIRS

7-37. General

Carrier field expedient repairs are identical to the upper repairs. Refer to paragraph 3-34 and make temporary repairs as described.

Section VII. RADIO INTERFERENCE SUPPRESSION

7-38. General

The radio interference suppression components used on the carrier engine are identical to those used on the upper engine, and the method of testing and replacing the components is also identical. Refer to Part I, Chapter III, Section VII and service the carrier radio interference suppression components.

Section VIII. ORGANIZATIONAL MAINTENANCE PROCEDURES

7-39. General

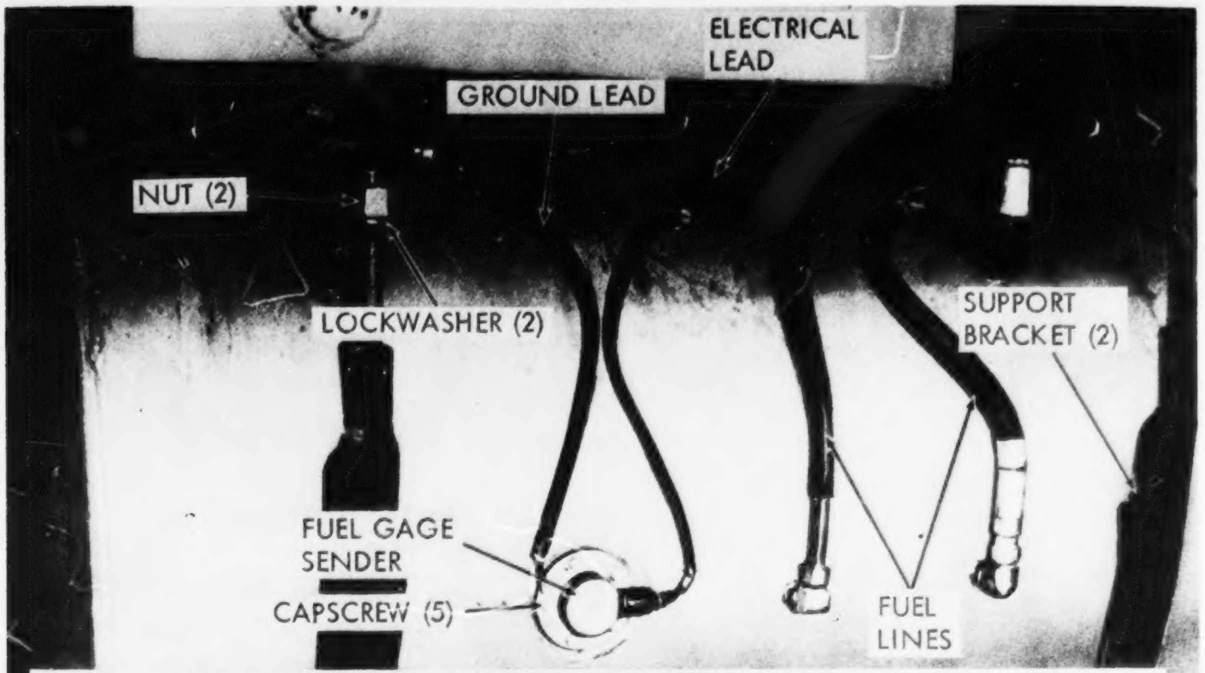
The maintenance procedures allocated to organizational level personnel are described in this section. The procedures are grouped according to machine functions, beginning with those procedures having to do with the engine.

7-40. Engine Fuel System

a. *General*. The engine fuel system consists of the fuel tank, lines fuel pump, sediment bowl, carburetor, cold weather starting aid pump, engine governor, and other components listed in this paragraph. Organizational level maintenance authorized for the fuel system follows.

The vapor given off by gasoline is inflammable. Therefore, every precaution must be taken to prevent the vapor from igniting. Before working on any fuel system component, stop the engine and allow it to cool. Do not allow gasoline to come into contact with any part of the machine, and drain the fuel tank whenever any work is performed on the fuel tank.

b. *Fuel Tank Replacement*. Refer to figure 7-13 and replace the fuel tank.



STEP 1. REFER TO FIGURE 7-10 AND DRAIN GASOLINE FROM FUEL TANK INTO SUITABLE CONTAINER.

STEP 2. DISCONNECT FUEL LINES, FUEL GAGE ELECTRICAL LEAD, AND GROUND LEAD. SUPPORT FUEL TANK AND REMOVE NUTS AND LOCKWASHERS FROM SUPPORT BRACKETS. REMOVE FUEL TANK. REMOVE CAPSCREWS AND FUEL GAGE SENDER.

STEP 3. POSITION FUEL GAGE SENDER IN NEW FUEL TANK IN THE SAME POSITION AS IT WAS IN OLD FUEL TANK AND INSTALL CAPSCREWS.

STEP 4. POSITION FUEL TANK IN SUPPORT BRACKETS AND INSTALL LOCKWASHERS AND NUTS. CONNECT FUEL LINES, GAGE ELECTRICAL LEAD, AND GROUND LEAD.

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Figure 7-13. Fuel tank, removal and replacement.

c. Fuel Pump.

(1) *Removal.* Refer to figure 7-7 and remove the fuel pump as follows:

(*a*) Remove the screws, lockwashers, and nuts which hold the cover to the carrier frame.

(*b*) Disconnect the fuel lines and electrical leads from the fuel pump.

(*c*) Remove the screws, lockwashers, and nuts from the fuel pump bracket, and remove the fuel pump.

(2) *Replacement.* Refer to figure 7-7 and replace the fuel pump as follows:

(*a*) Attach the fuel pump to the carrier frame with screws, lockwashers, and nuts.

(*b*) Reconnect the fuel lines and electrical lead.

(*c*) Attach the cover with screws, lockwashers and nuts.

d. Fuel Lines and Fittings.

(1) *Repair.* Clean all accessible items shown in figure 7-14 and replace any damaged items.

(2) *Replacement.* Refer to figure 7-14 and remove and replace any damaged items.

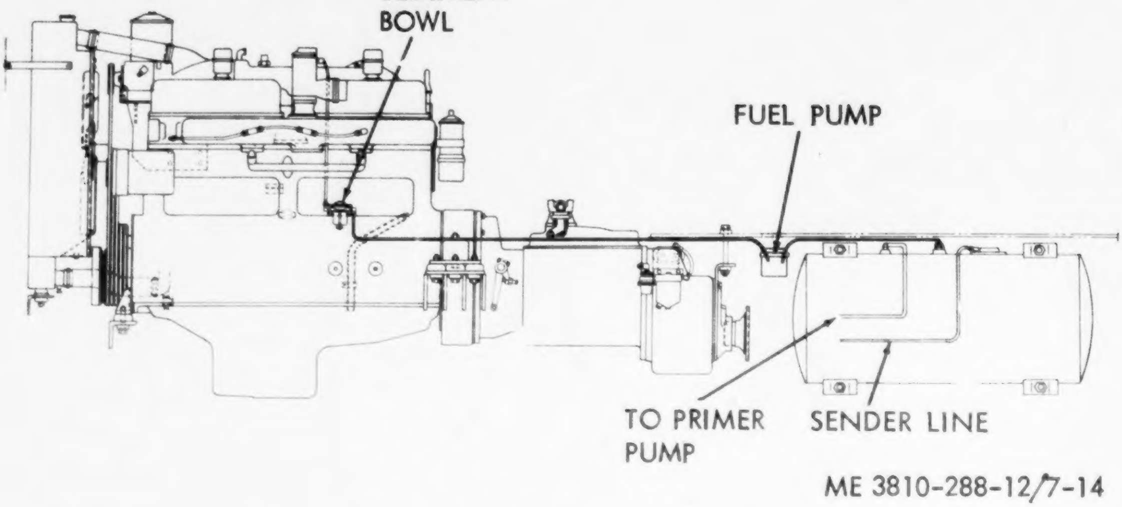


Figure 7-14. Fuel lines and fittings, replacement and repair.

e. Sediment Bowl.

(1) *Removal.* Refer to figure 7-6 and remove the sediment bowl as follows:

(*a*) Disconnect the fuel lines as shown.

(*b*) Remove nut.

(2) *Replacement.* Refer to figure 7-6 and replace the sediment bowl as follows:

(*a*) Position sediment bowl as shown and install nut.

(*b*) Reconnect fuel lines.

f. Carburetor.

(1) *Adjustment.* Carburetor adjustments must not be made before reading the following explanation. The carburetor mounting flange must be firmly mounted. The flange gasket must not leak. If a flange nut is loose, air will enter at the flange leak to completely alter engine performance. An adjustment under these circumstances can not be done properly. Also, the fuel tank must be suspected as a cause of trouble before adjusting the carburetor. An unusual amount of fuel contamination may partly block the tank outlet or fuel lines, causing the carburetor to be starved for fuel. Under these circumstances, the fuel tank must be drained and cleaned (para. 7-15) before adjusting the carburetor. If the air cleaner oil is not clean, is of the wrong type, or is filled too full, it will restrict air flow to the carburetor, making it appear that the carburetor needs adjustment. All of these items must be checked before adjusting the carburetor. Remove the access cover in the operator's cab by turning the screws a quarter turn and remove the access cover as shown in figure 7-15. Refer to figure 7-15 and adjust the carburetor.

(2) *Removal.* Refer to figure 7-15 and remove the carburetor as follows:

(*a*) Loosen the hose clamp and slide the hose off the carburetor air intake. Remove the screw and nut which hold the clamp on the throttle cable. Remove the nut on the end of the accelerator linkage and remove the accelerator linkage and throttle cable from the carburetor.

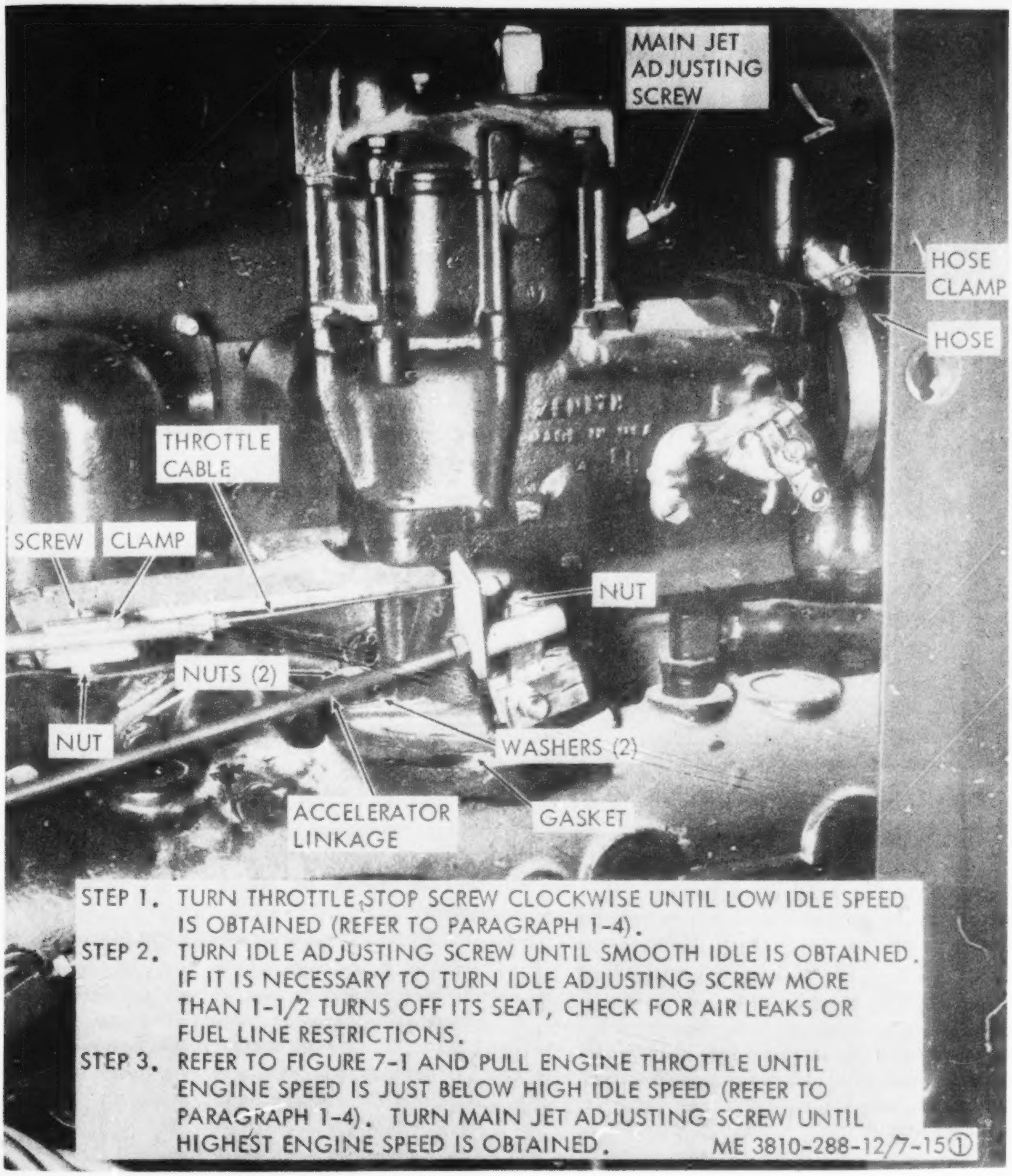
(*b*) Disconnect the fuel line from the carburetor. Remove the cotter pin and pin from the governor linkage, and remove the governor linkage.

(*c*) Remove the nuts and washers which hold the carburetor to the intake manifold.

(3) *Replacement.* Refer to figure 7-15 and replace the carburetor as follows:

(*a*) Install a new intake manifold gasket on the intake manifold. Place the carburetor on the intake manifold and install the washers and nuts.

(*b*) Connect the governor linkage to the


MAIN JET ADJUSTING SCREW
HOSE CLAMP
HOSE
THROTTLE CABLE
SCREW
CLAMP
NUT
NUTS (2)
NUT
WASHERS (2)
ACCELERATOR LINKAGE
GASKET

STEP 1. TURN THROTTLE STOP SCREW CLOCKWISE UNTIL LOW IDLE SPEED IS OBTAINED (REFER TO PARAGRAPH 1-4).

STEP 2. TURN IDLE ADJUSTING SCREW UNTIL SMOOTH IDLE IS OBTAINED. IF IT IS NECESSARY TO TURN IDLE ADJUSTING SCREW MORE THAN 1-1/2 TURNS OFF ITS SEAT, CHECK FOR AIR LEAKS OR FUEL LINE RESTRICTIONS.

STEP 3. REFER TO FIGURE 7-1 AND PULL ENGINE THROTTLE UNTIL ENGINE SPEED IS JUST BELOW HIGH IDLE SPEED (REFER TO PARAGRAPH 1-4). TURN MAIN JET ADJUSTING SCREW UNTIL HIGHEST ENGINE SPEED IS OBTAINED.

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Figure 7-15. Carburetor, adjustment, removal and replacement. (Sheet 1 of 2)

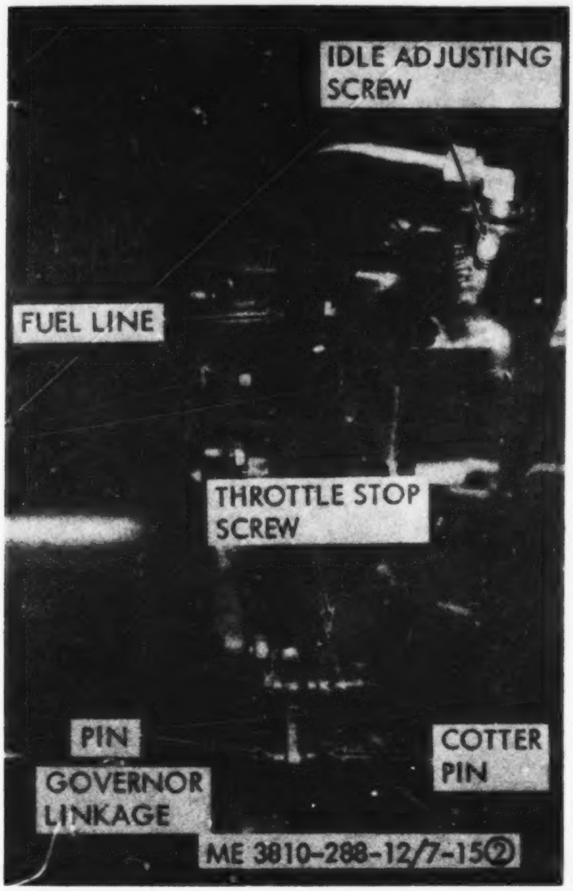


Figure 7-15. Carburetor, adjustment, removal and replacement. (Sheet 2 of 2)

carburetor as shown and secure it to the carburetor with the pin and cotter pin. Connect the fuel line.

(*c*) Install the accelerator linkage on the carburetor and tighten the screw in the end of the accelerator linkage. Position the throttle cable as shown and install the clamp, screw and nut. Slide the hose over the carburetor air intake and tighten the hose clamp. Adjust the carburetor as described above.

g. Air Cleaner.

(1) *Removal.* Refer to figure 7-9 and remove the air cleaner as follows:

(*a*) Loosen the hose clamps and slide the hose off the air intake pipe. Remove the screws and nuts on the bands.

(*b*) Spread the bands and remove the air cleaner.

(2) *Replacement.* Refer to figure 7-9 and replace the air cleaner as follows:

(*a*) Spread the bands and install the air cleaner in the bands as shown.

(*b*) Install the screws and nuts in the bands. Slide the hose over the air intake pipe and tighten the hose clamps.

h. Engine Speed Governor.

(1) *Adjustment.* Refer to figure 7-16 and adjust the engine speed governor.

(2) *Removal.* Refer to figure 7-16 and remove the engine speed governor as follows:

(*a*) Remove the cotter pin and pin to disconnect the governor linkage from the governor. Disconnect the oil lines.

(*b*) Remove the capscrew and washer from the governor spring bracket. Remove the nuts and governor mounting clamp. Remove the governor.

(3) *Replacement.* Refer to figure 7-16 and replace the governor as follows:

(*a*) Position the governor on the engine, install the governor mounting clamp on the top mounting stud, and install the nuts on the mounting studs.

(*b*) Attach the governor spring bracket to the engine with the capscrew and washer. Connect the governor linkage to the governor with the pin and secure the pin with the cotter pin.

(*c*) Connect the oil lines as shown. Check the adjustment of the governor as described above.

i. Engine Starting Aid Pump and Lines.

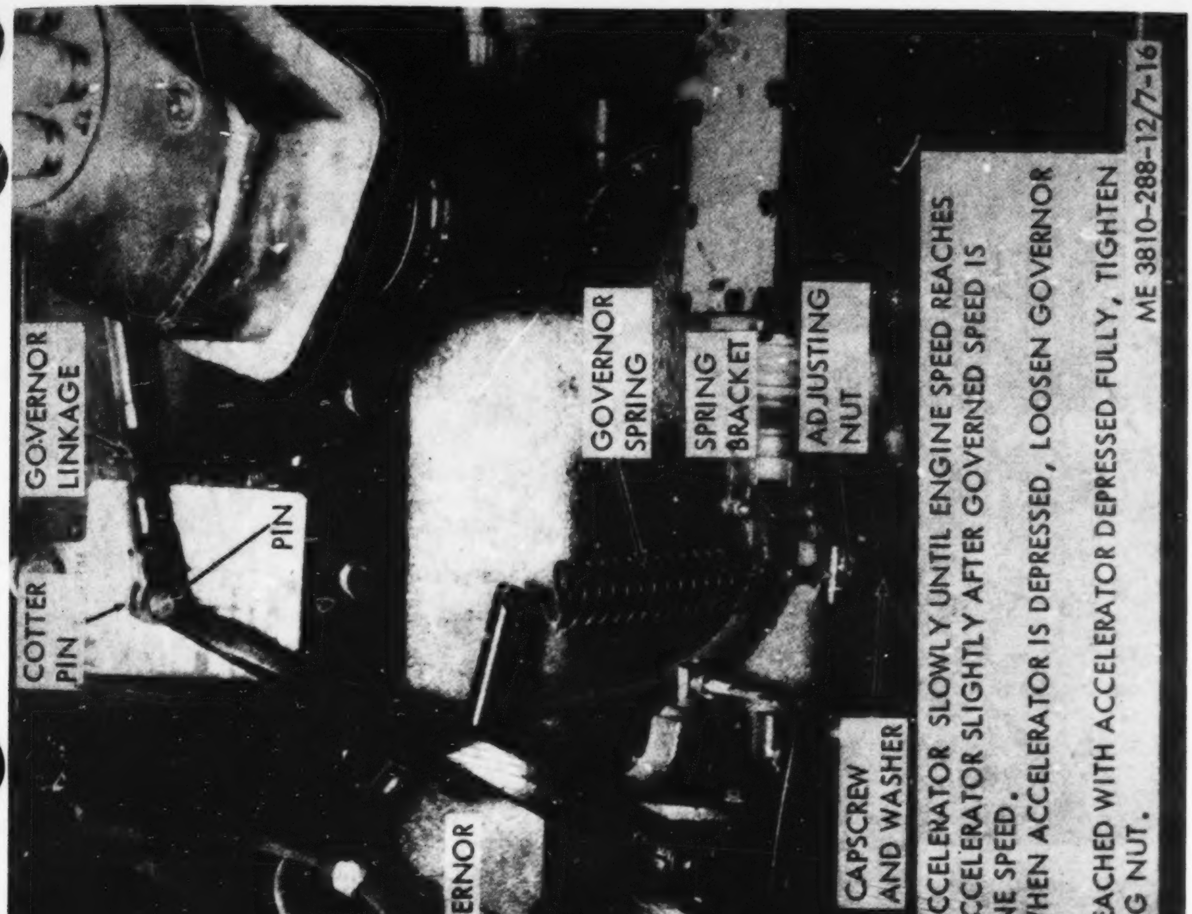
(1) *Pump replacement.* Refer to figure 7-17 and remove and replace the engine starting aid pump. Note that the bottom of pump (7) unscrews from the top portion of the pump.

(2) *Lines or fitting repair.* Refer to figure 7-17 and replace any damaged starting air fuel lines or fittings.

j. Accelerator and Throttle.

(1) *Replacement.* Refer to figure 7-18 and remove and replace the accelerator and throttle control.

(2) *Repair.* Refer to figure 7-18 and replace any damaged portion of the accelerator or throttle control.


COTTER PIN
GOVERNOR LINKAGE
PIN
GOVERNOR SPRING
SPRING BRACKET
ADJUSTING NUT
CAPSCREW AND WASHER
GOVERNOR
OIL LINES (2)
MOUNTING CLAMP
NUTS (2)

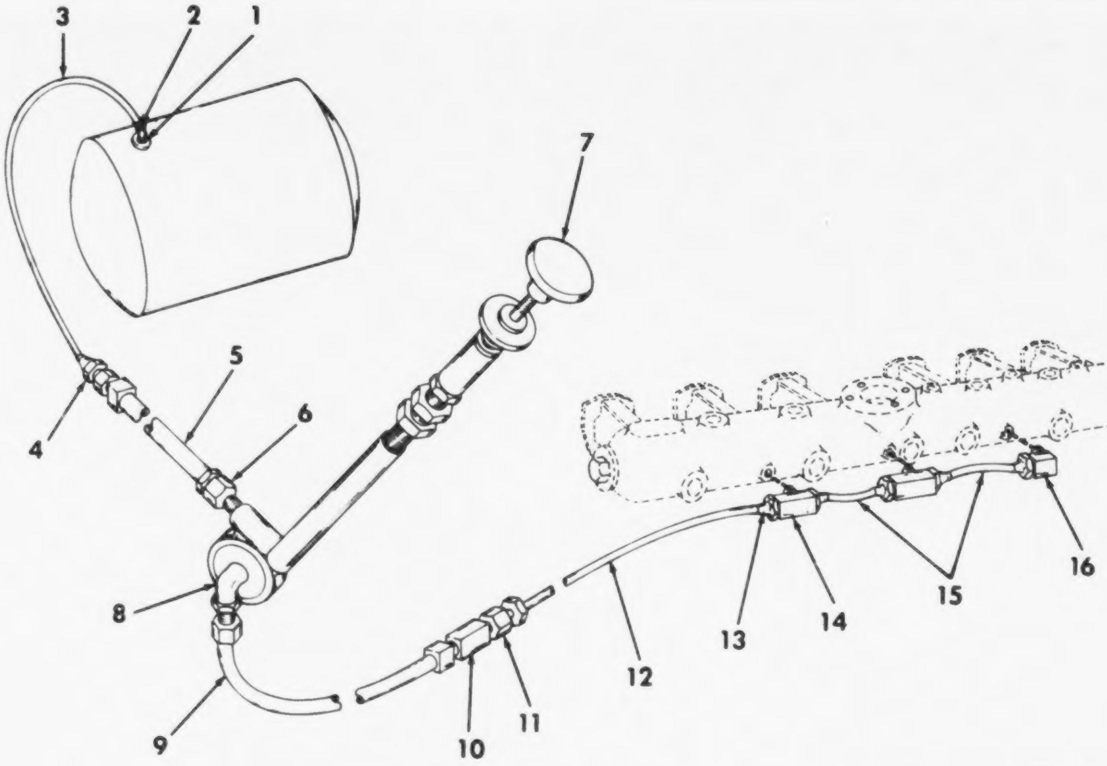
STEP 1. START ENGINE AND DEPRESS ACCELERATOR SLOWLY UNTIL ENGINE SPEED REACHES GOVERNED SPEED. DEPRESS ACCELERATOR SLIGHTLY AFTER GOVERNED SPEED IS REACHED AND OBSERVE ENGINE SPEED.

STEP 2. IF ENGINE SPEED INCREASES WHEN ACCELERATOR IS DEPRESSED, LOOSEN GOVERNOR SPRING ADJUSTING NUT.

STEP 3. IF GOVERNED SPEED IS NOT REACHED WITH ACCELERATOR DEPRESSED FULLY, TIGHTEN GOVERNOR SPRING ADJUSTING NUT.

ME 3810-288-12/7-16

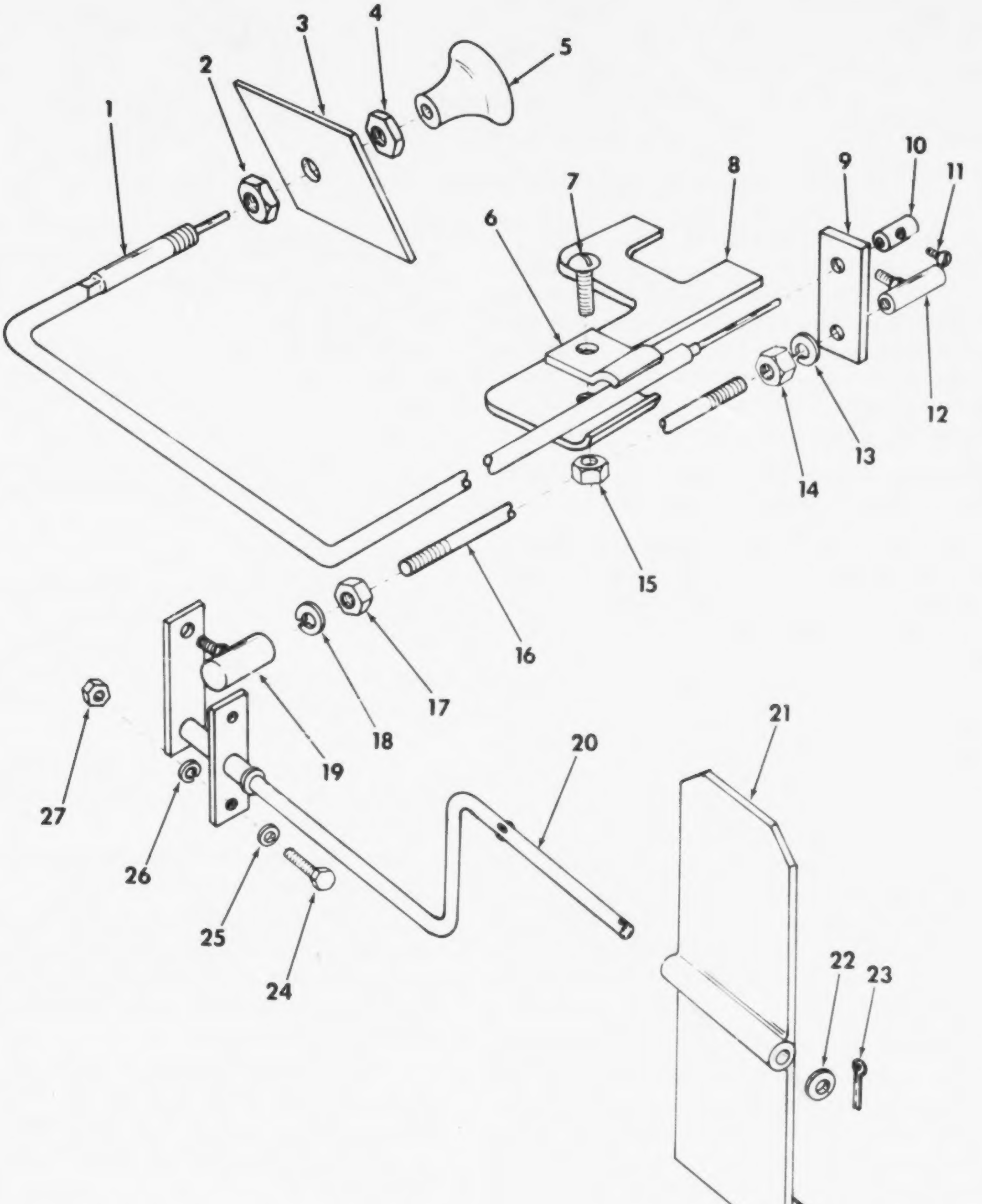
Figure 7–16. Engine speed governor, adjustment, removal and replacement.



ME 3810-288-12/7-17

1. Elbow
2. Nut, flared
3. Tube
4. Connector, female
5. Hose
6. Connector
7. Pump, starting aid
8. Elbow
9. Hose
10. Coupling, pipe
11. Connector, inverted male
12. Tube
13. Nut, flared
14. Tee
15. Tube
16. Elbow

Figure 7-17. Engine starting aid pump and lines, removal, replacement, and repair.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ME 3810-288-12/7-18

Figure 7-18. Accelerator and throttle control, removal, replacement, and repair.

1. Cable, throttle control
2. Nut, jam
3. Dash panel
4. Nut, jam
5. Knob
6. Clamp
7. Screw
8. Bracket, clamp
9. Plate
10. Clamp, cable
11. Screw
12. Rod end
13. Washer, lock
14. Nut, jam
15. Nut
16. Rod, throttle control
17. Nut, jam
18. Washer, lock
19. Rod end
20. Rod, accelerator pedal
21. Accelerator pedal
22. Washer
23. Pin, cotter
24. Capscrew
25. Washer
26. Washer, lock
27. Nut

Figure 7-18. Accelerator and throttle control, removal, replacement, and repair.

7-41. Engine Electrical System

a. General. This machine has a 24 volt, negative ground electrical system. Refer to figure 5-2 for a view of the electrical system schematic diagram. The system consists of two 12 volt batteries, starting motor, an alternator with an internal voltage regulator, and minor components as shown in the schematic diagram.

***Warning:* Always disconnect battery cables before working on electrical components.**

b. Batteries and Cables. The carrier batteries and cables are identical to the upper batteries and cables. Refer to paragraph 3-49j for methods of testing, replacing, and repairing the carrier batteries and cables.

c. Alternator. The carrier alternator is identical to the upper alternator, and the method of testing, replacing, and adjusting the alternator and drive components is also identical. Refer to paragraph 3-49b and test, replace, and adjust the alternator and drive components.

d. Reverse Polarity Relay. The carrier reverse polarity relay is identical to the upper reverse polarity relay, and the method of testing and replacing the relay is also identical. Refer to paragraph 3-49*i* and test and replace the carrier reverse polarity relay.

e. Starting Motor and Solenoid. The carrier starting motor and solenoid are identical to the upper starting motor and solenoid, with the exception of the size of the carrier starting motor. The carrier starting motor is larger. The method of testing, removing, and replacing the carrier starting motor and solenoid is identical to the testing, removing, and replacing of the upper starting motor and solenoid. Refer to paragraph 3-49*c* and test and replace the carrier starting motor and solenoid.

f. Ignition System. The carrier ignition system, which includes the distributor, coil, suppression leads, and spark plugs, is identical to the upper ignition system. Refer to paragraphs 3-49*d*, 3-49*e*, and 3-49*f* for methods of testing, adjusting, and replacing the components of the carrier ignition system.

g. Slave Cable Receptacle. The carrier slave cable receptacle is identical to the upper slave cable receptacle. Refer to figure 3-55 and replace a faulty slave cable receptacle.

h. Lights. The replacement and repair of all the lights on the machine is covered in paragraph 3-49*h*.

i. Horn Button.

(1) *Removal.* Refer to figure 7-19 and remove the horn button as follows:

(*a*) Twist the horn button and emblem plate counterclockwise. Remove contact cup and spring. Remove the screws in the base plate assembly and remove the plate.

(*b*) Remove wheel nut and wheel. Carefully pull the horn contact roller assembly out of the steering column.

(2) *Replacement.* Refer to figure 7-19 and replace the horn button as follows:

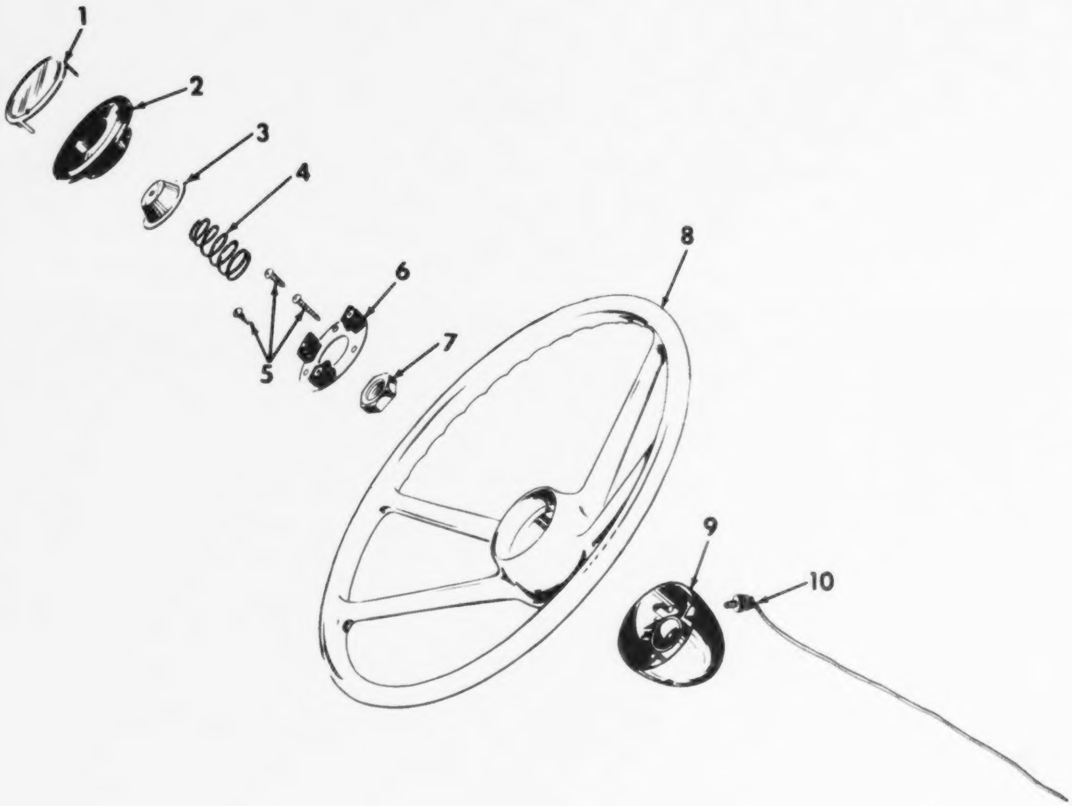
(*a*) Insert the wire on the horn contact roller assembly through opening in turn signal housing and down through wire trough in jacket tube. Press horn contact roller assembly into turn signal housing.

(*b*) Install wheel and wheel nut. Torque the wheel nut to 55-65 foot pounds. Assemble the spring, contact cup horn button and emblem plate by pushing down, with palm of hand, and turning clockwise.

j. Instrument Panel and Wiring Harness.

(1) *Instrument panel, switch, and gage replacement.* Refer to figure 7-20 and remove and replace a damaged instrument panel or a defective switch or gage.

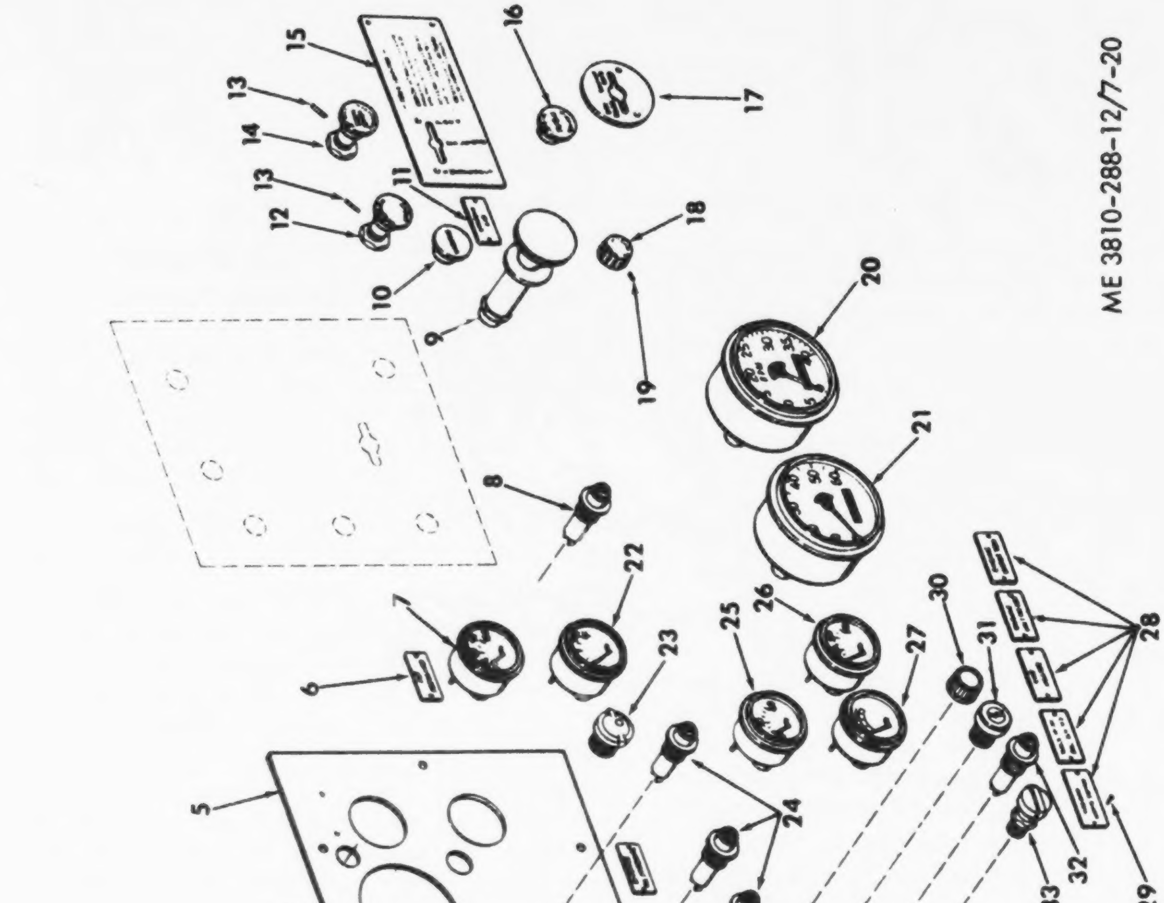
***Warning:* Always disconnect battery cables before working on electrical components.**



1. EMBLEM PLATE
2. HORN BUTTOM
3. CONTACT CUP
4. SPRING
5. METAL TAPPING SCREW
6. BASE PLATE ASSY.
7. WHEEL NUT
8. WHEEL
9. TURN SIGNAL HOUSING
10. HORN CONTACT ROLLER ASSEMBLY

M': 3810-288-12/7-19

Figure 7-19. Horn button, removal and replacement.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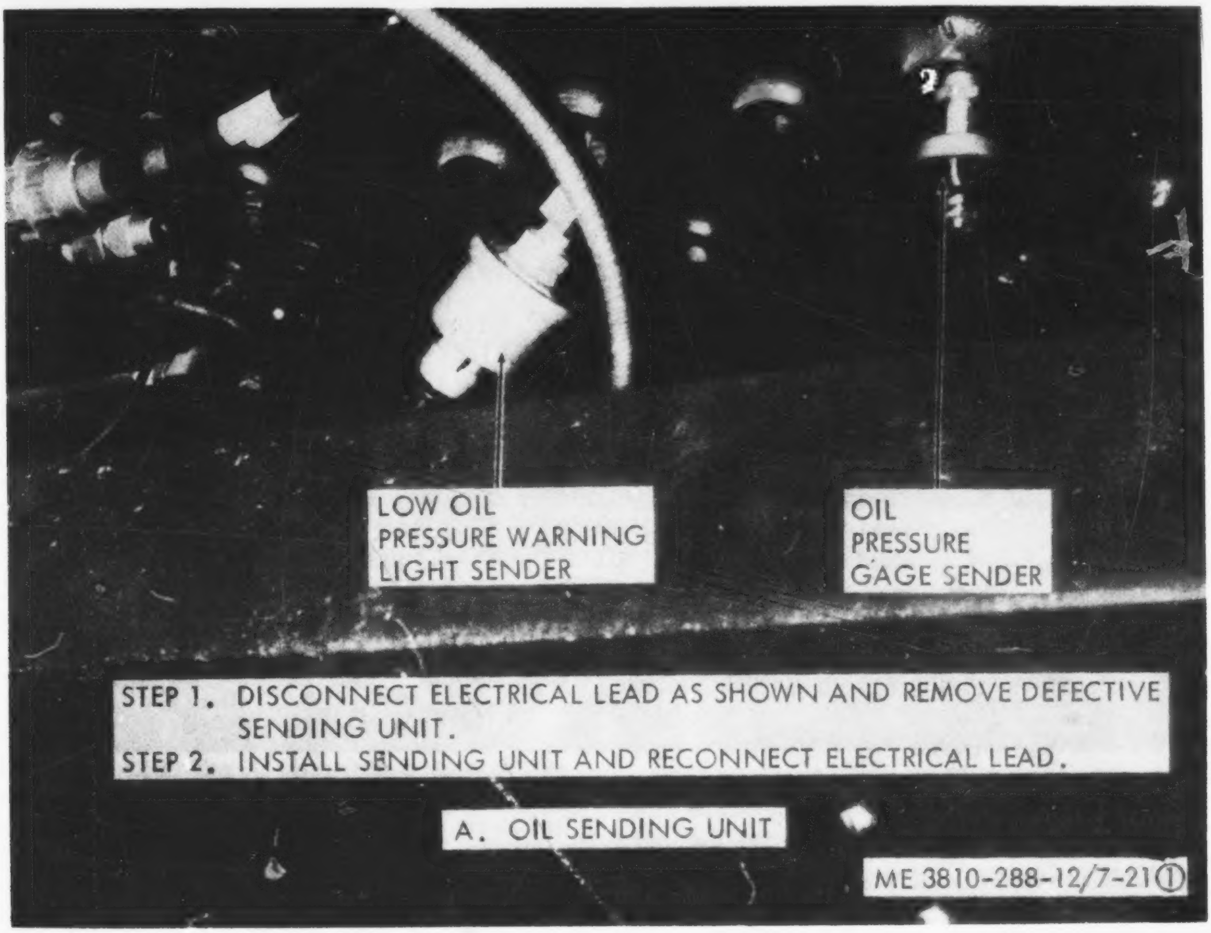
ME 3810-288-12/7-20

1. Nut
2. Bracket
3. Bracket
4. Nut
5. Plate
6. Plate, name
7. Gauge
8. Lamp
9. Pump
10. Knob, throttle
11. Plate, name
12. Knob, air brake
13. Pin
14. Knob, air brake
15. Plate, instruction
16. Knob, differential lockout
17. Plate, instruction
18. Knob, windshield wiper
19. Setscrew
20. Tachometer-hourmeter
21. Speedometer-odometer
22. Gauge, carrier fuel
23. Switch, panel lamp
24. Lamp
25. Gauge, oil pressure
26. Gauge, water temperature
27. Voltmeter
28. Plate, name
29. Screw, drive
30. Switch, cab heater
31. Receptacle, ignition
32. Lamp
33. Switch, hazard warning
34. Switch, lamp selector
35. Plate, speed chart
36. Screw
37. Switch, toggle

Figure 7-20. Instrument panel switch, and gage, removal and replacement.



STEP 1. DISCONNECT ELECTRICAL LEAD AS SHOWN AND REMOVE DEFECTIVE SENDING UNIT.
STEP 2. INSTALL SENDING UNIT AND RECONNECT ELECTRICAL LEAD.

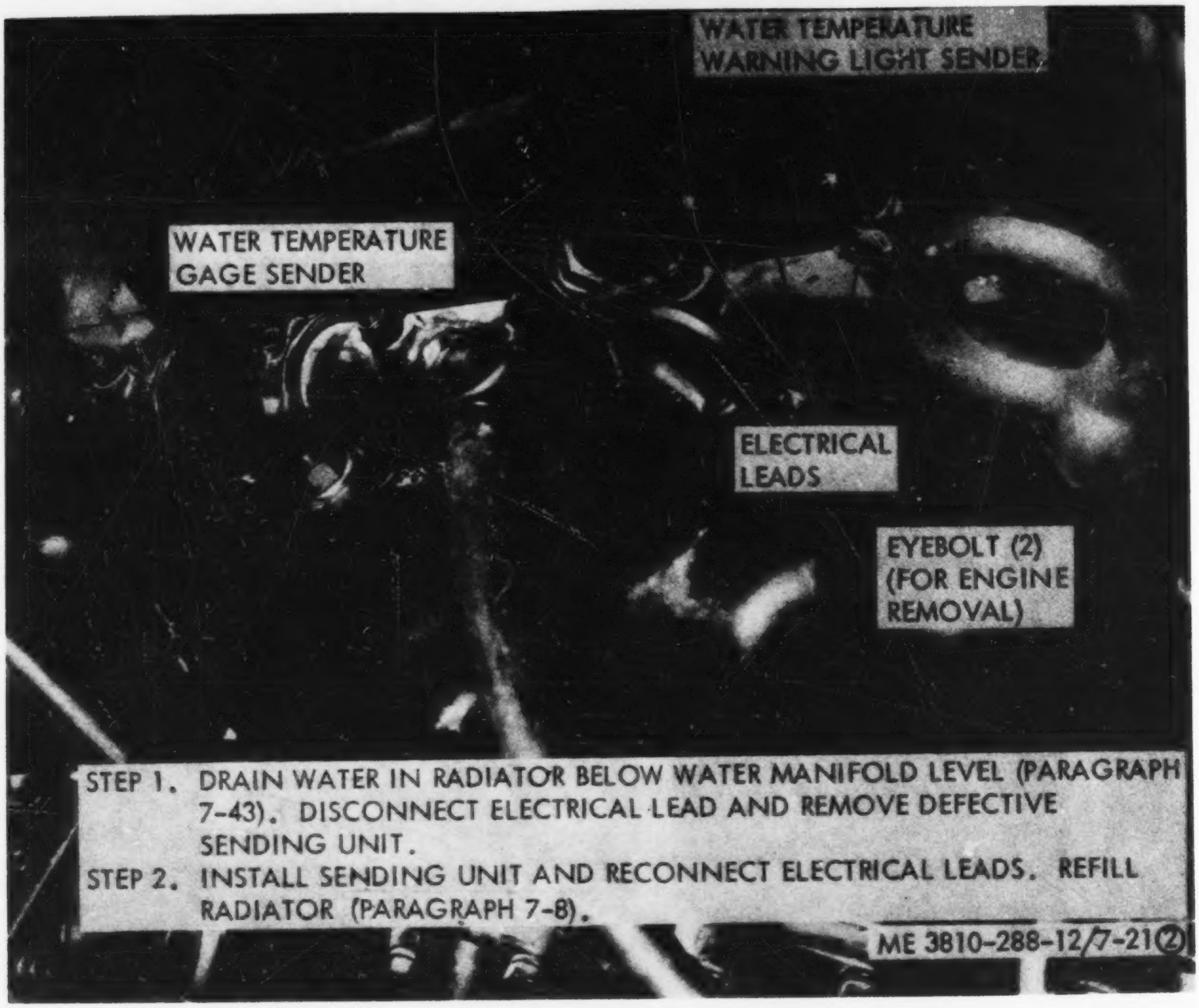
Figure 7-21. Sending units, removal and replacement. (Sheet 1 of 2)

(2) *Wiring harness repair.* The method of repairing the instrument panel wiring harness is the same as the method used in repairing any other wiring harness. Refer to paragraph 3-49*k* and repair the instrument panel wiring harness.

k. Sending units. Refer to figure 7-21 and remove and replace a defective oil pressure or water temperature sending unit. Refer to figure 7-13 and remove and replace a defective fuel tank sending unit.

l. Trailer Coupling and Chassis Wiring.

(1) *Trailer coupling replacement.* There are two trailer couplings on the machine. One is mounted on the rear of the carrier frame and the other is mounted on the rear of the outrigger box. The method of removing both of the trailer


WATER TEMPERATURE WARNING LIGHT SENDER
WATER TEMPERATURE GAGE SENDER
ELECTRICAL LEADS
EYEBOLT (2) (FOR ENGINE REMOVAL)

STEP 1. DRAIN WATER IN RADIATOR BELOW WATER MANIFOLD LEVEL (PARAGRAPH 7-43). DISCONNECT ELECTRICAL LEAD AND REMOVE DEFECTIVE SENDING UNIT.
STEP 2. INSTALL SENDING UNIT AND RECONNECT ELECTRICAL LEADS. REFILL RADIATOR (PARAGRAPH 7-8).

ME 3810-288-12/7-21②

Figure 7-21. Sending units, removal and replacement. (Sheet 2 of 2)

couplings is identical. Refer to figure 7-22 and remove and replace a defective trailer coupling.

(2) *Chassis wiring repair.* The method of repairing the chassis wiring harness is the same as the method used in repairing any other wiring harness. Refer to paragraph 3-49*k* and repair any damaged chassis wiring.

7-42. Engine Lubricating System

a. General. The maintenance of the engine lubricating system allocated to Organizational Maintenance include the oil pan, oil filter, and external oil lines, and is described in the following paragraphs.

b. Oil Pan

(1) *Inspection.* Inspect the oil pan for leaks or other physical damage. Report any leaks or damage to Direct Support Maintenance. Refer to figure 7-1, reference 6 and check the oil level. Be sure to clean the area around the dipstick to prevent dirt from entering the oil pan.

(2) *Service.* Servicing of the oil pan consists of keeping the oil pan clean, and adding oil when the oil level in the oil pan is below the full mark on the dipstick. Refer to lubrication order and add oil of the type listed as required.

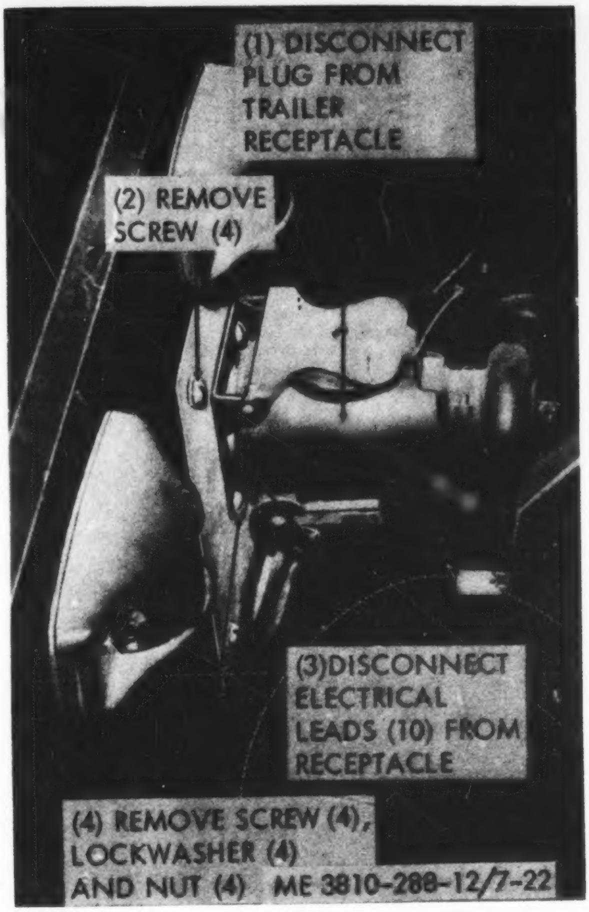

(1) DISCONNECT PLUG FROM TRAILER RECEPTACLE
(2) REMOVE SCREW (4)
(3)DISCONNECT ELECTRICAL LEADS (10) FROM RECEPTACLE
(4) REMOVE SCREW (4), LOCKWASHER (4) AND NUT (4)
ME 3810-288-12/7-22

Figure 7-22. Trailer coupling, removal and replacement.

c. Oil Filter

(1) *Service.* Refer to figure 7-26 and remove access cover (37) behind the engine cowling. Drain the oil in the oil filter into a suitable container. Refer to figure 7-23 and loosen the band clamp nut and remove the band clamp, cover, and filter element. Install a new filter element and fill the oil filter with oil to within ¾ inches of the top. Replace the cover and band clamp and tighten the band clamp nut. Run the engine until the oil has warmed to normal operating temperature and check for leaks.

(2) *Replacement.* Refer to figure 7-26 and remove access cover (37) behind the engine cowling. Drain the oil in the oil filter into a suitable container. Tag and disconnect the hoses from the oil filter. Support the oil filter and remove the nuts, bolts, and lockwashers from the oil filter bands. Remove the oil filter and remove the drain pipe at the bottom of the oil filter. Position a new oil filter in the oil filter bands, and support it in place. Install the bolts through both oil filter bands, and install lockwashers and nuts on the bolts. Reconnect the hoses to the oil filter, and install and drain pipe on the bottom of the oil filter. Refer to paragraph (1) above and fill the oil filter with oil.

d. External Oil Lines.

(1) *General.* The external oil lines on this engine, include the metal pipes which connect the air compressor and oil cooler to the engine block, and the hoses which connect the oil filter to the oil cooler. All external oil lines, with the exception of the oil filter hoses, have yellow bands painted on each end.

(2) *Replacement.* Refer to figure 7-24 and remove and replace the external oil lines.

(3) *Repair.* Repair any broken, kinked, or damaged oil line by replacing it with a new oil line. Refer to (2) above and replace any damaged oil lines.

e. Oildex Filter. The Oildex filter for the carrier engine is located as shown on figure 7-24. Service, removal, and replacement procedures are identical to those given for the same filter used on the upper engine. Refer to figure 3-28 and service the Oildex filter.

7-43. Engine Cooling System

a. General. The cooling system consists of a radiator, water pump, thermostat, engine water manifold, fan, and lines and tubing as required to complete the cooling circuit. The thermostat controls the flow of coolant pumped through the engine to cool the engine. Flow is from the radiator to the pump, through the engine, and back to the radiator for recirculation.

b. Radiator. Remove the radiator as follows:

(1) Refer to figure 7-25 and drain the coolant from the system.

(2) Refer to figure 7-43 and remove the alcohol evaporator, and the radiator braces on each side of the radiator. Remove the panel on the right side of the operator's cab, in order to gain access to the radiator braces.

(3) Remove the windshield washer fluid container and hoses. Refer to figure 7-26 and remove the hood and front engine cowling.

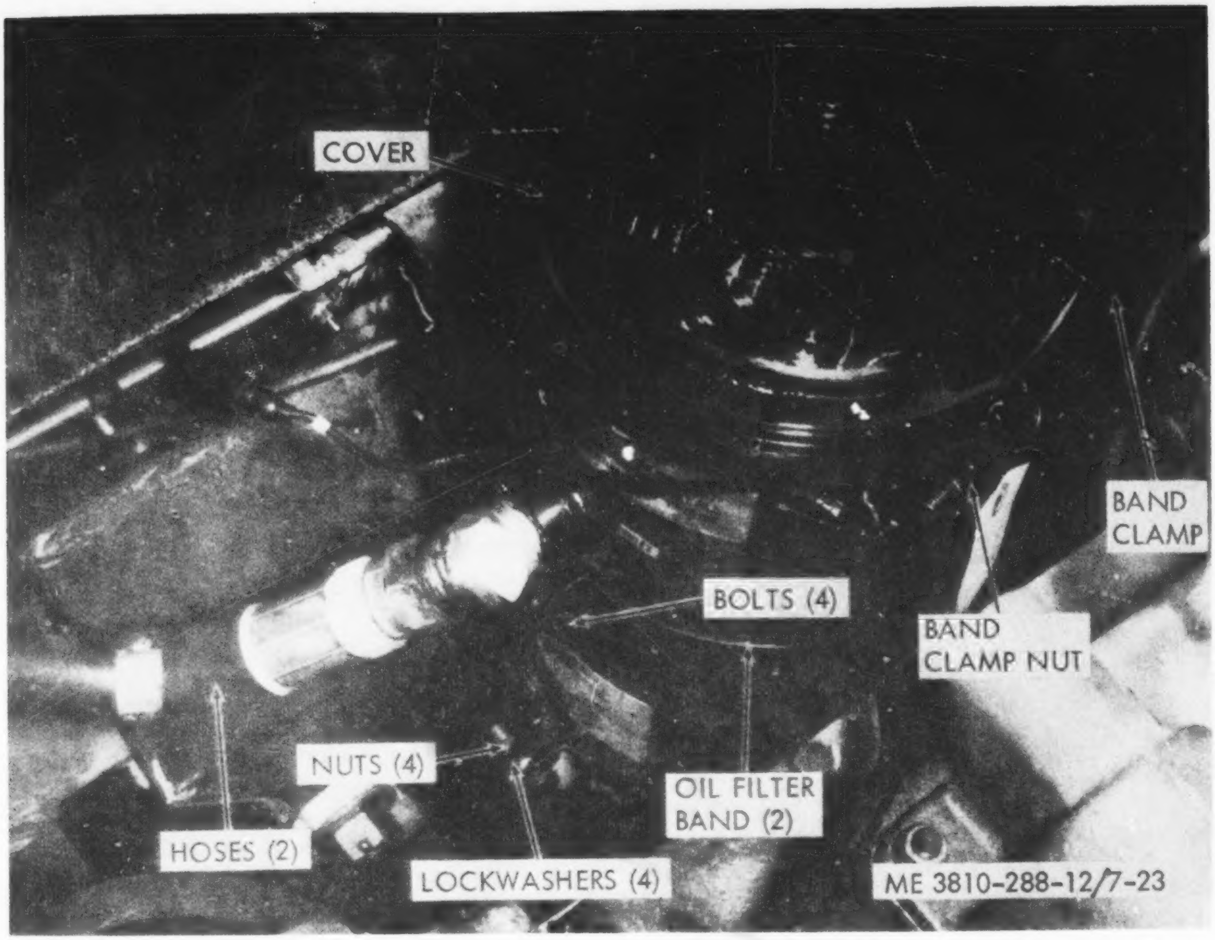

COVER
BAND CLAMP
BOLTS (4)
BAND CLAMP NUT
NUTS (4)
OIL FILTER BAND (2)
HOSES (2)
LOCKWASHERS (4)
ME 3810-288-12/7-23

Figure 7-23. Oil filter, service and replacement.

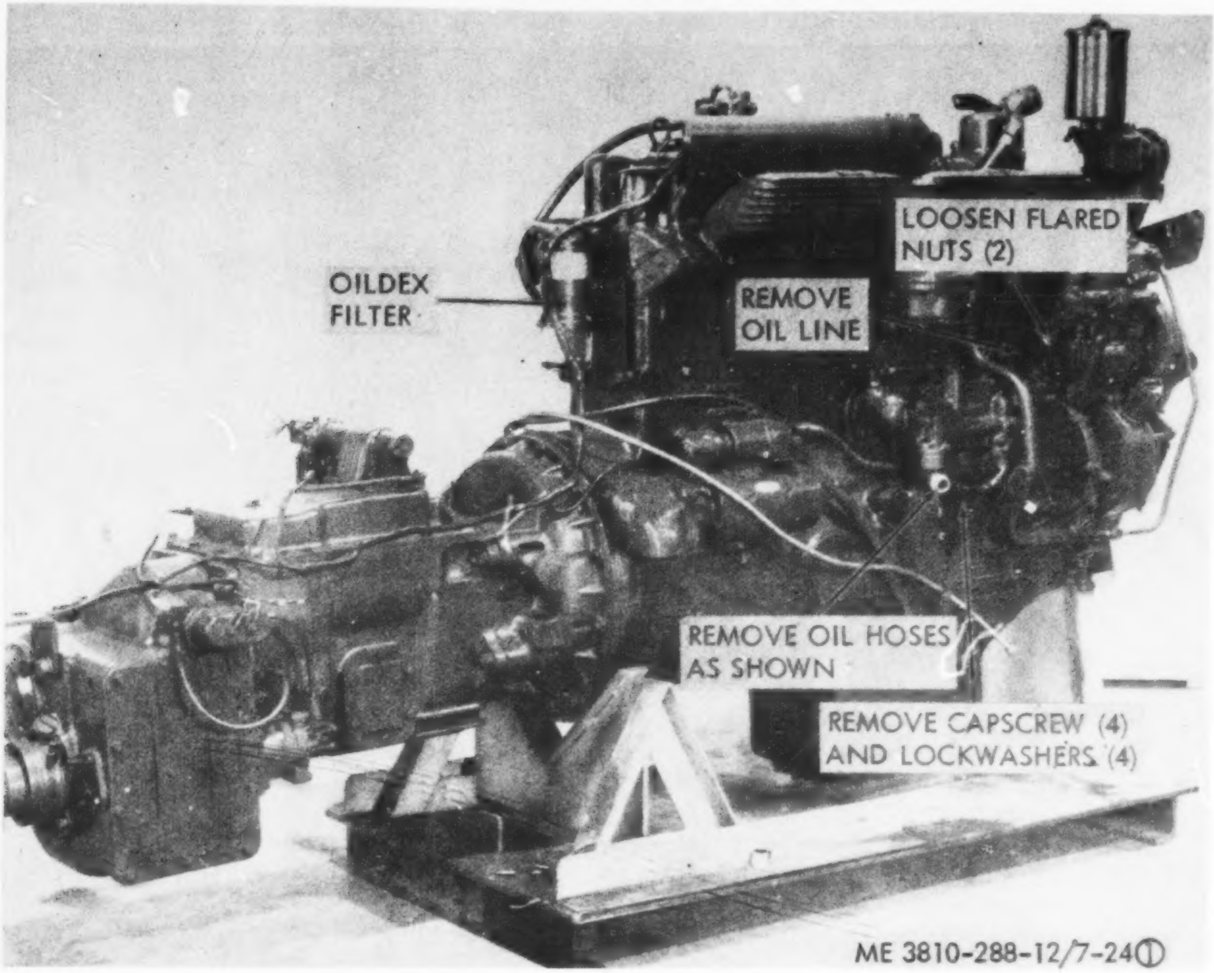
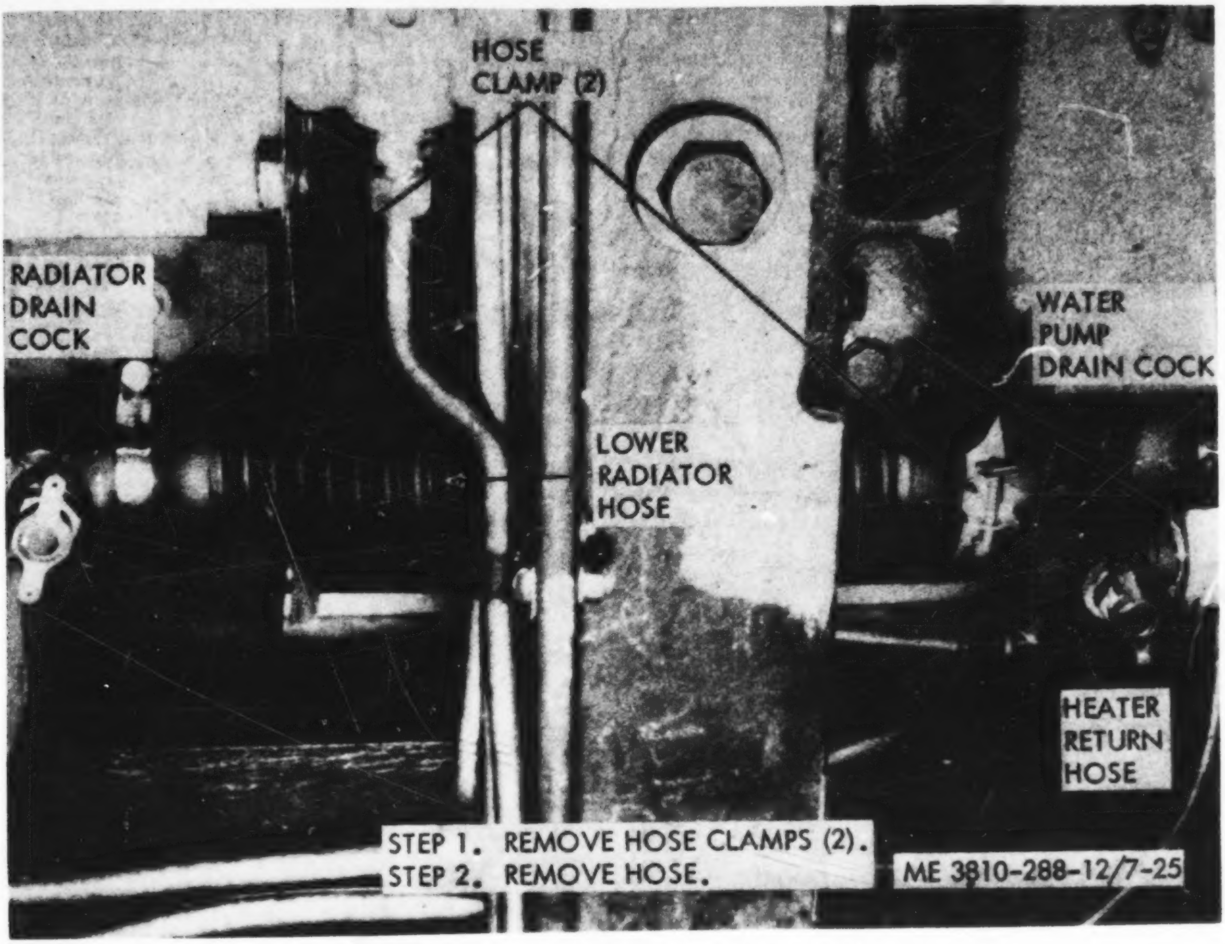

OILDEX FILTER
LOOSEN FLARED NUTS (2)
REMOVE OIL LINE
REMOVE OIL HOSES AS SHOWN
REMOVE CAPSCREW (4) AND LOCKWASHERS (4)
ME 3810-288-12/7-24①

Figure 7-24. External oil lines, replacement and repair. (Sheet 1 of 2)

LOOSEN FLARED NUTS (2)
REMOVE OIL LINE
ME 3810-288-12/7-24(2)

Figure 7-24. External oil lines, replacement and repair. (Sheet 2 of 2)


HOSE CLAMP (2)
RADIATOR DRAIN COCK
WATER PUMP DRAIN COCK
LOWER RADIATOR HOSE
HEATER RETURN HOSE
ME 3810-288-12/7-25

STEP 1. REMOVE HOSE CLAMPS (2).
STEP 2. REMOVE HOSE.

Figure 7-25. Radiator and water pump drain cocks.

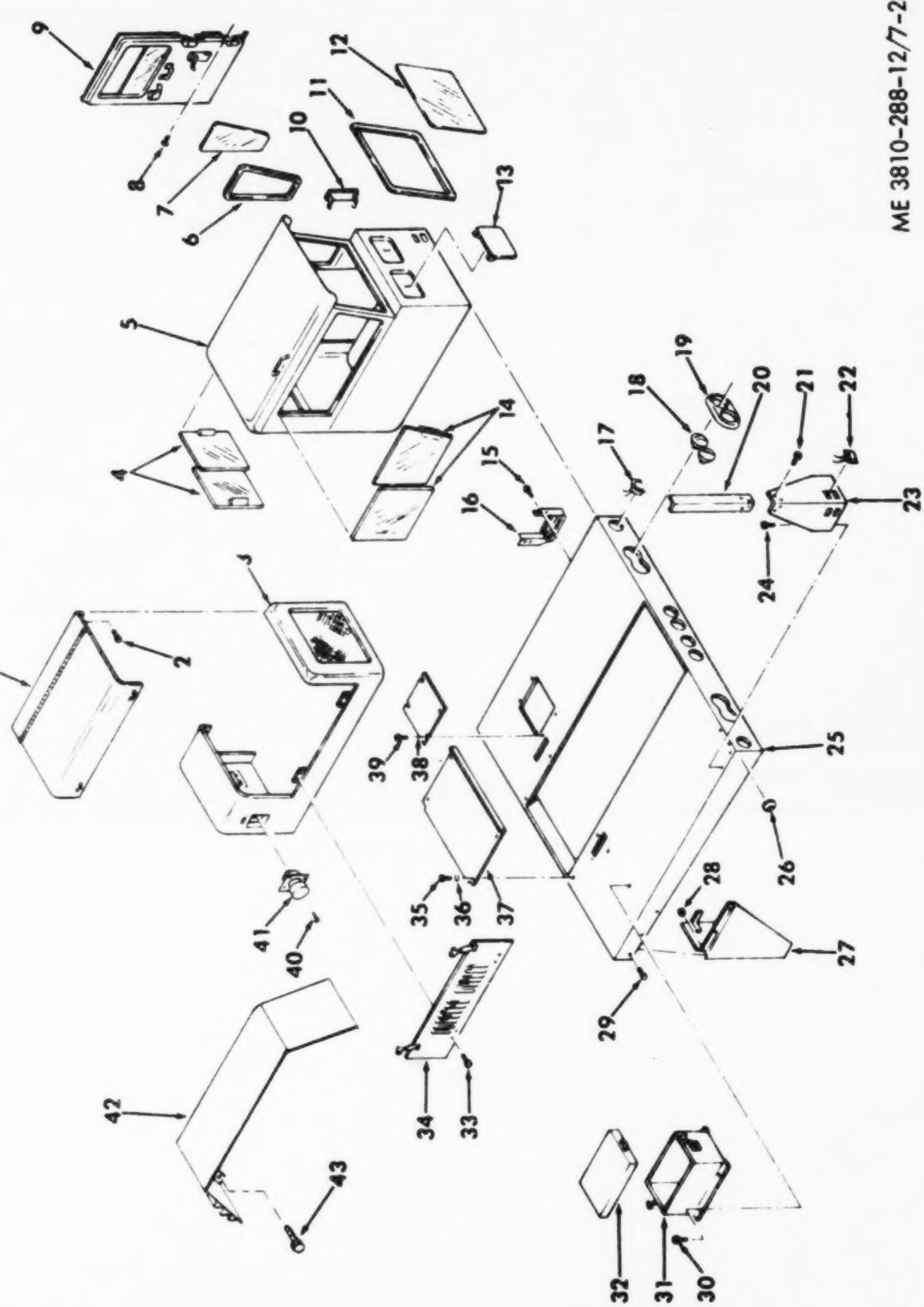

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Figure 7-26. Carrier cab assembly, removal and replacement.

1. Top, hood
2. Capscrew
3. Rail, front center assembly
4. Window, rear
5. Cab
6. Weatherstripping
7. Window
8. Capscrew
9. Door assembly
10. Vent door
11. Weatherstripping
12. Window
13. Vent door
14. Window
15. Capscrew
16. Bracket, ladder
17. Lamp, park and directional
18. Headlight
19. Headlamp door
20. Stand, mirror
21. Capscrew
22. Lights, running and blackout
23. Base, mirror mounting
24. Capscrew
25. Platform
26. Reflector
27. Skirt, platform
28. Nut
29. Capscrew
30. Capscrew
31. Box, battery
32. Cover
33. Capscrew
34. Side, hood
35. Capscrew
36. Lockwasher
37. Cover, access
38. Bracket, seat mounting
39. Capscrew
40. Capscrew
41. Receptacle, slave
42. Fender, rear
43. Capscrew

Figure 7-26. Carrier cab assembly, removal and replacement.

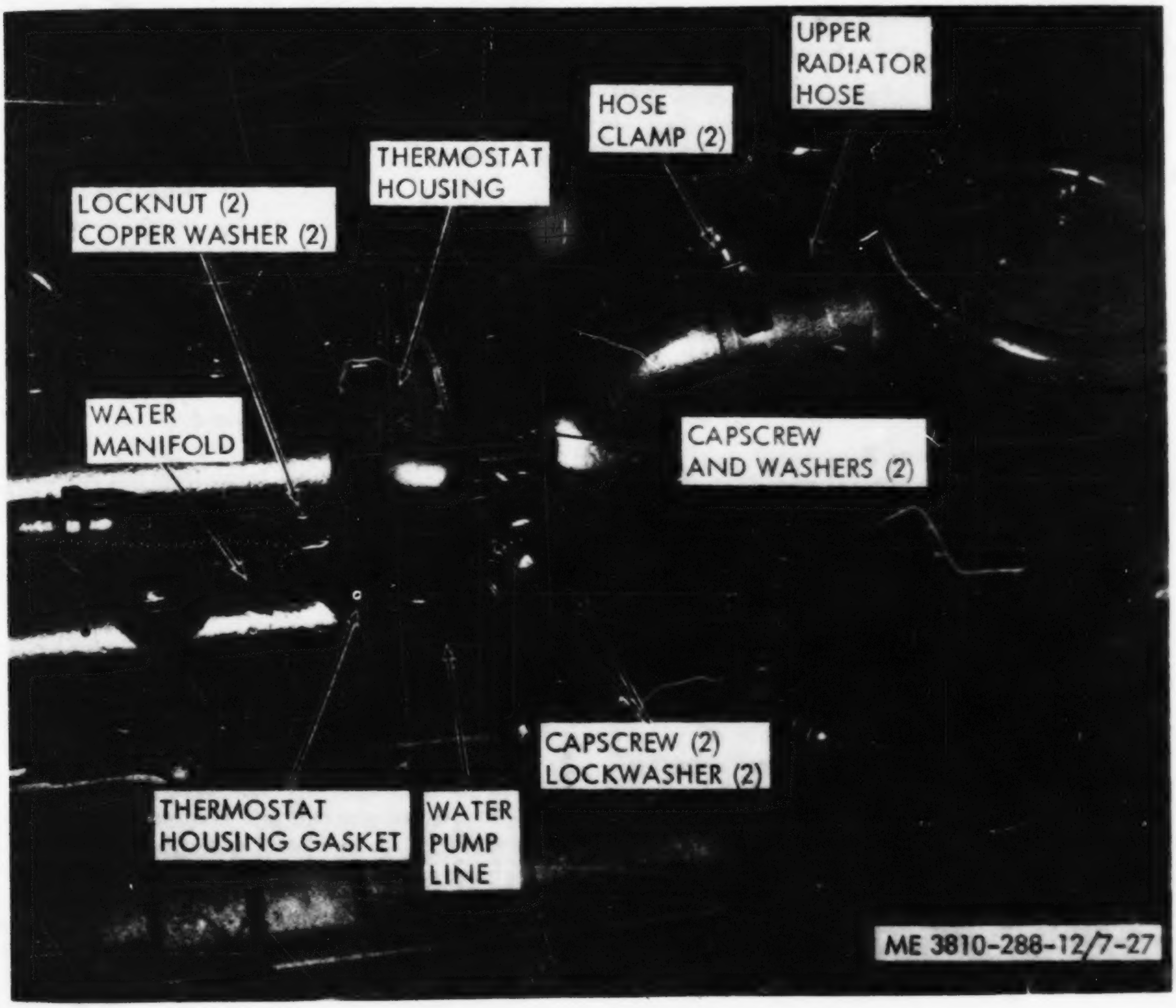

UPPER RADIATOR HOSE
HOSE CLAMP (2)
THERMOSTAT HOUSING
LOCKNUT (2) COPPER WASHER (2)
WATER MANIFOLD
CAPSCREW AND WASHERS (2)
CAPSCREW (2) LOCKWASHER (2)
THERMOSTAT HOUSING GASKET
WATER PUMP LINE
ME 3810-288-12/7-27

Figure 7-27. Thermostat housing, and hoses, removal and replacement.

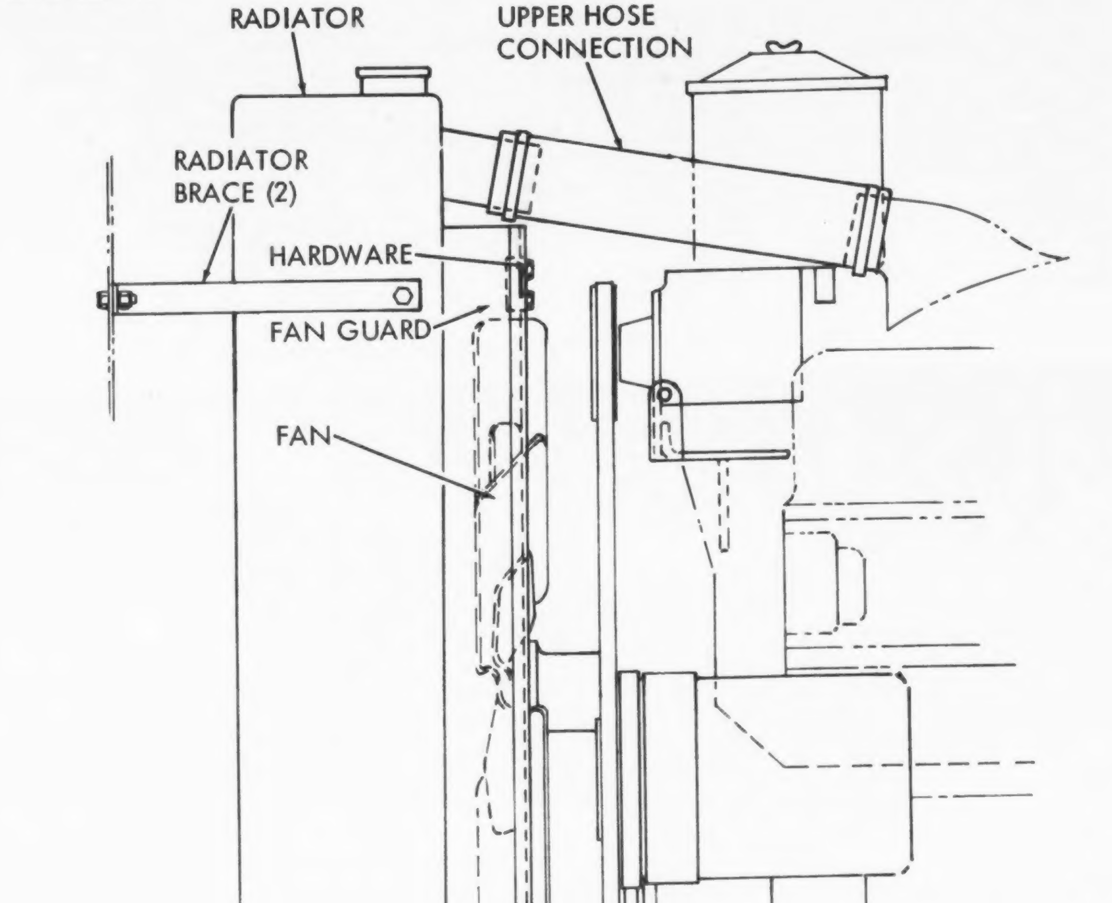

RADIATOR
UPPER HOSE CONNECTION
RADIATOR BRACE (2)
HARDWARE
FAN GUARD
FAN
LOWER HOSE CONNECTION
SHOCK MOUNT (4)
STUD SPACER (2)
NUT (2), LOCKWASHER (2) AND PLAIN WASHER (2)
ME 3810-288-12/7-28

Figure 7-28. Radiator mounting material, remove and replacement.

(4) Refer to figure 7-27 and remove the upper hose connected between the thermostat housing and the radiator.

(5) Refer to figure 7-25 and remove the lower radiator hose connection.

Note. The radiator must be adequately braced during removal.

(6) Refer to figure 7-28 and remove the radiator mounting nuts, lockwashers, plain washers, shock mounts, and stud spacers. Remove the radiator braces. Using a suitable lifting device, remove the radiator.

c. Radiator Cap.

(1) *Test.* The radiator cap is rated at 7 to 13 psi. If the cap is suspected of leaking, and failure to maintain this pressure, test it on a cap tester if available.

(2) *Replacement.* If the cap is suspected of leaking and no radiator cap pressure tester is available, unscrew the radiator cap (fig. 7-2) and replace it with a new cap rated at 7 to 13 psi.

d. Thermostat and Housing.

(1) *Removal.* Drain the coolant below the level of the thermostat housing (fig. 7-27) before removing the thermostat housing. Refer to figure 7-25 for the location of the drain cocks. Then remove the thermostat housing and lines as follows: (fig. 7-27)

(*a*) Remove upper radiator hose and attaching hose clamps.

(*b*) Remove water pump line by removing attaching capscrews and lockwashers.

(*c*) Remove the locknuts, capscrews and copper washers which secure the thermostat housing to the water manifold and remove the thermostat housing. Replace the thermostat housing gasket, and remove the thermostat. The thermostat is located in the front end of the thermostat housing.

(2) *Testing.* Refer to paragraph 3-48 and test the thermostat. Replace a faulty thermostat and reinstall the thermostat housing as described above.

e. Water Manifold.

(1) *Removal.* Drain the coolant below the level of the water manifold. Remove the thermostat and thermostat housing as described in above. Then remove the water manifold as follows:

(*a*) Refer to figure 7-21 and remove the water temperature senders.

(*b*) Loosen the heater inlet hose clamp and remove the heater inlet hose from the water manifold (fig. 7-29).

(*c*) Remove the two hose clamps from the ends of the water manifold hose.

(*d*) Remove the locknuts and copper washers which secure the manifold to the cylinder heads. Remove the water manifolds and manifold hose as an assembly. Replace the manifold gaskets when reinstalling the manifolds.

(2) *Replacement.*

(*a*) Refer to figure 7-29 and replace the water manifolds and lines.

(*b*) Refer to figure 7-27 and replace the thermostat, thermostat housing and lines.

(*c*) Refer to figure 7-21 and install water temperature senders.

f. Water Pump.

(1) *Removal.* Before removing the water pump, drain the radiator through the drain cocks illustrated in figure 7-25. Then proceed as follows:

(*a*) Refer to figure 7-25 and disconnect the heater return hose. Loosen the hose clamps and remove the lower radiator hose.

(*b*) Remove the oil cooler hose (fig. 7-30) by loosening the two hose clamps.

(*c*) Six bolts secure the water pump to the timing gear portion of the crankcase. Four of these bolts enter the water pump from the radiator end of the engine. Two of these bolts are longer than the other two and are used to secure the water pump belt guard in position in front of the water pump sheave. Support the water pump, refer to figure 7-31 and remove the six water pump housing bolts, including the two which secure the belt guard. Remove the belt guard.

(*d*) There are two short bolts which secure the water pump housing to the timing cover. These bolts are located behind the water pump housing. Remove these two bolts.

(*e*) Refer to figure 7-31, loosen the jam nut, and back off the water pump belt adjusting screw. Slip the water pump belt off the pump sheave. The water pump sheave is held in place by a locknut and washer arrangement identical to the arrangement shown on the idler sheave. Re-

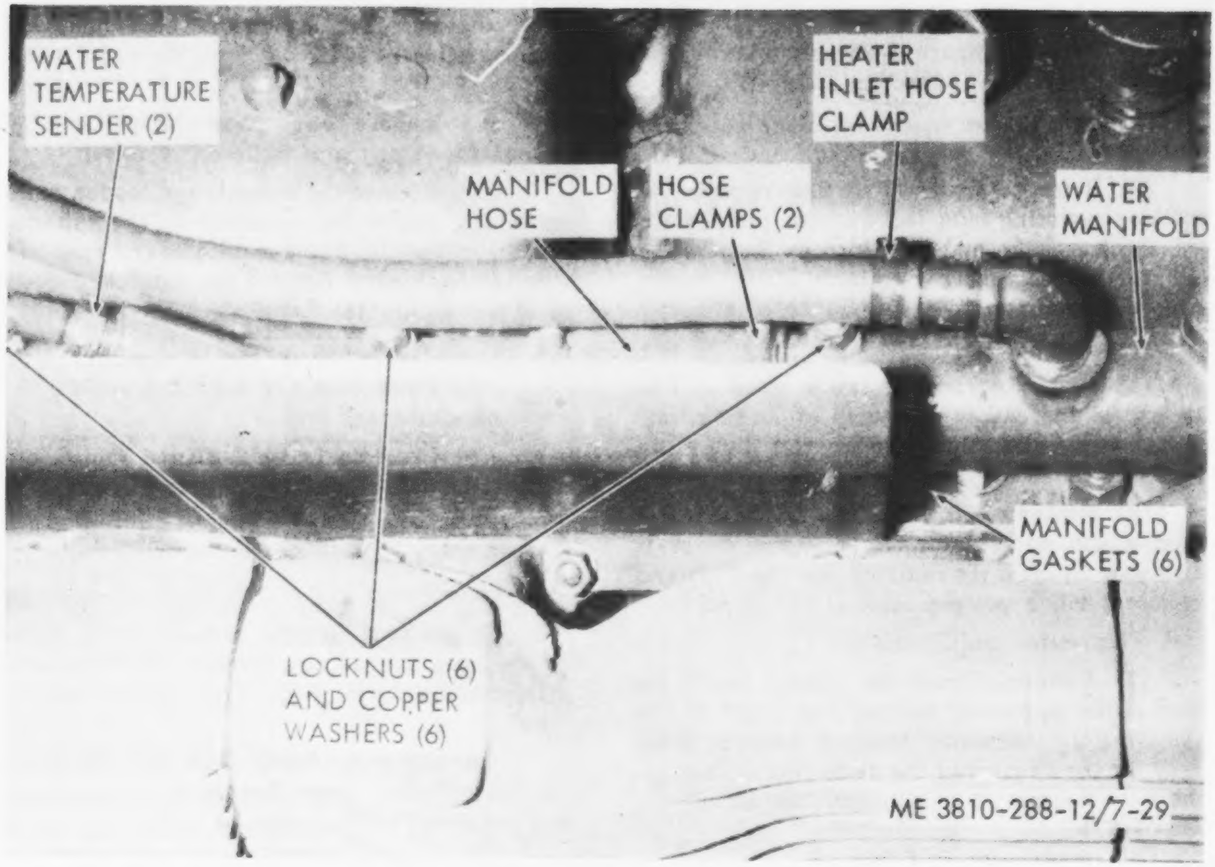


Figure 7-29. Water manifold and lines, removal and replacement.

move the locknut and lockwasher securing the water pump sheave, and remove the water pump from the engine. Be careful to support the water pump adequately, using a suitable lifting device.

(*f*) If the water pump belt is to be replaced, refer to paragraph 7-41*c*, loosen the alternator drive belt tension. Refer to figure 7-32 and loosen the fan belts. Slip the alternator and fan belts off. The water pump belt can now be removed and replaced. Refer to figure 7-31 for the method of relieving tension on the water pump belt.

(2) *Installation.* Refer to figures 7-30 and 7-31 to install the water pump. Refer to figure 7-31 and adjust water pump belt tension so that the midspan slack does not exceed ½ inch at the point indicated. To adjust, loosen the jam nut and turn down on the water pump belt adjusting screw. Tighten the jam nut to secure the belt in the desired condition.

g. Fan and Fan Belt.

(1) *General.* The fan belt sheave is equipped with a pipe plug. This pipe plug must be removed at the intervals listed in the lubrication order a grease fitting must be installed, and the sheave bearings are to be lubricated with the lubricant of the type listed.

(2) *Removal.* Remove the fan and fan belt as follows:

(*a*) Refer to figure 7-3 and remove the four fan mounting bolts.

(*b*) Remove the fan. Items 13 and 14, figure 7-32 will come off with the fan.

(*c*) Refer to paragraph 7-41*c*, loosen the alternator belts, and slip the alternator belts off the alternator sheave.

(*d*) Refer to paragraph 7-44, loosen the power steering pump drive belt, and slip the power steering pump belt off the pump sheave.

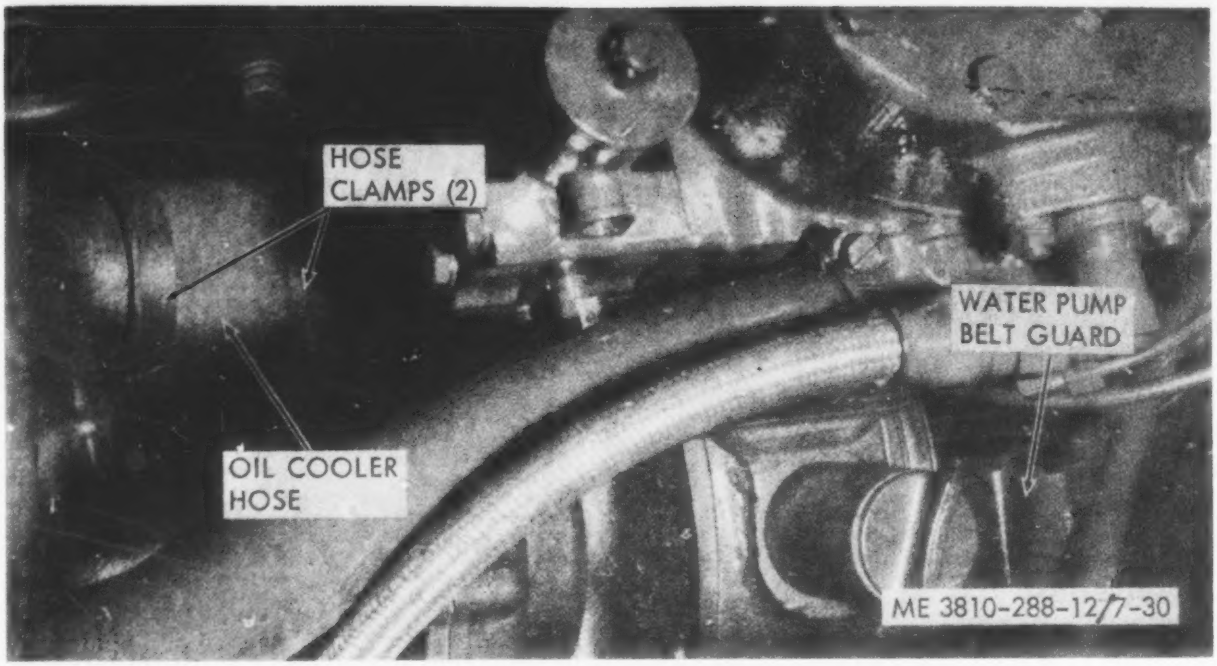


Figure 7-30. Water pump and lines, removal and replacement. replacement.

(*e*) Refer to figure 7-32 and loosen the fan hub bracket mounting bolts. Loosen the jam nut on the fan belt adjusting bolt and back off on the adjusting bolt until the belts are slack enough for removal. Remove the belts.

(*f*) If the fan sheave (fig. 7-34) is to be removed, it will be necessary to remove the radiator as instructed in paragraph 7-43*b*. Then proceed as follows:

(*g*) With the radiator removed, refer to figure 7-32 and continue with the removal of the fan sheave components. Note that items 9 through 14 have already been removed.

(*h*) Remove nut (15, fig. 7-32). Remove items (16 through 22), as an assembly, using a suitable puller bearing against the end of shaft (24) and screwed into the tapped holes in sheave (20). Remove all items mounted in sheave (20) by removing retaining ring (22). Then press out items (16 through 21).

(3) *Installation.* Install the components of the fan, fan sheave, and associated parts as shown in figure 7-32. When the sheave has been installed, lubricate in accordance with the lubrication order and adjust belt tension as follows.

(4) *Belt tension adjustment.* Leave the fan hub bracket mounting bolts loose (fig. 7-34). Loosen the jam nut and tighten the fan belt adjusting bolt until the fan belts have a maximum of about ½ inch midspan slack at the longest span. Tighten the fan hub bracket mounting bolts so that the correct belt tension will be maintained. Tighten the jam nut.

7-44. Power Steering System

a. General. The power steering system (fig. 5-3) consists of a vane type hydraulic steering pump which contains a fluid reservoir (fig. 7-35), the steering gear proper (fig. 7-33), which contains a hydraulic control valve and a power cylinder, and a mechanical means of steering control. The operator is able to steer the machine even if hydraulic power is lost, although additional effort will be required. Mechanical power from the steering gear is transmitted through the drag link (fig. 7-36) to the steering arms at each front wheel.

b. Power Steering Pump and Reservoir.

(1) *Removal.* Remove the power steering pump and reservoir and the pump drive belt as follows:

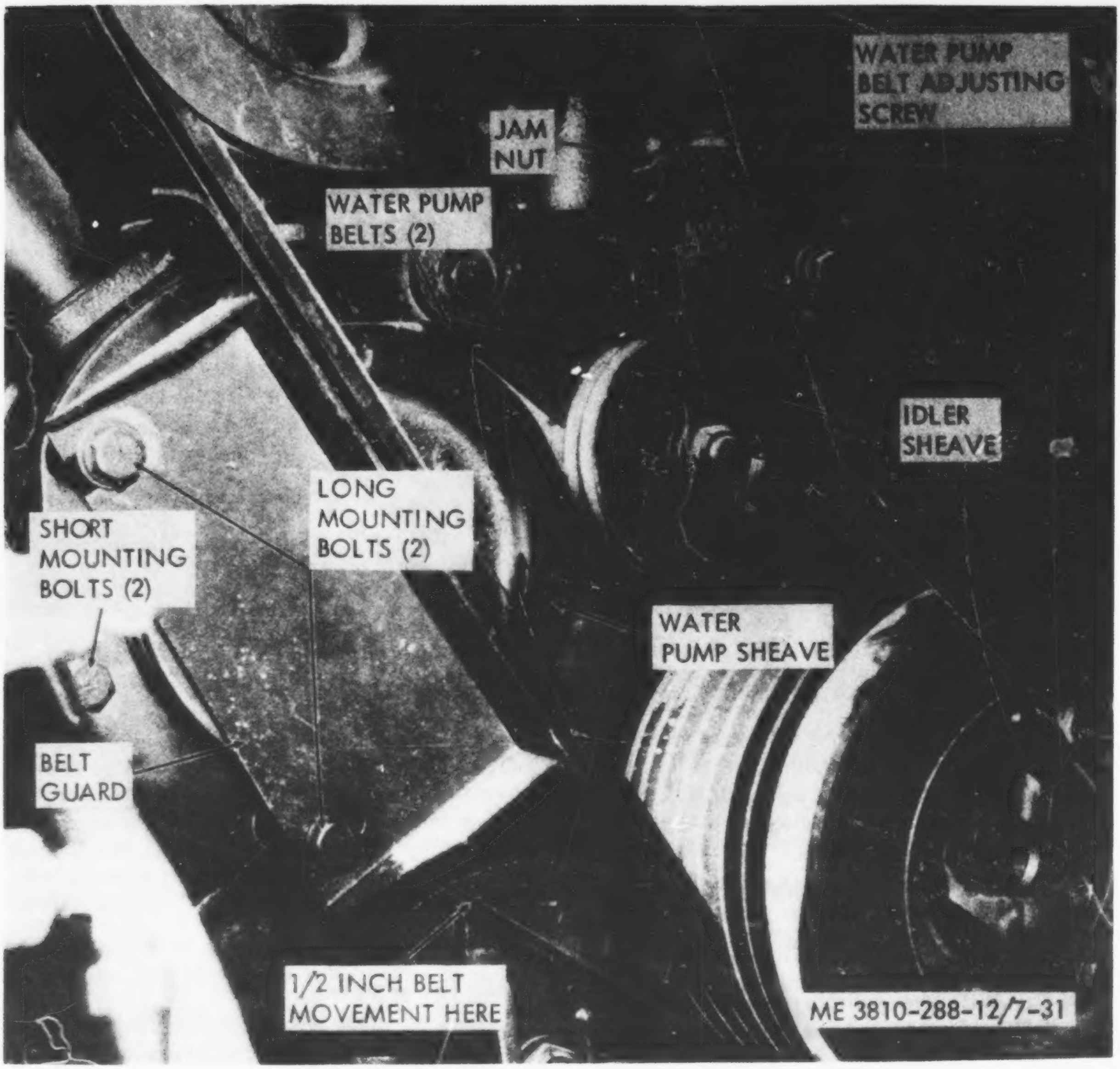
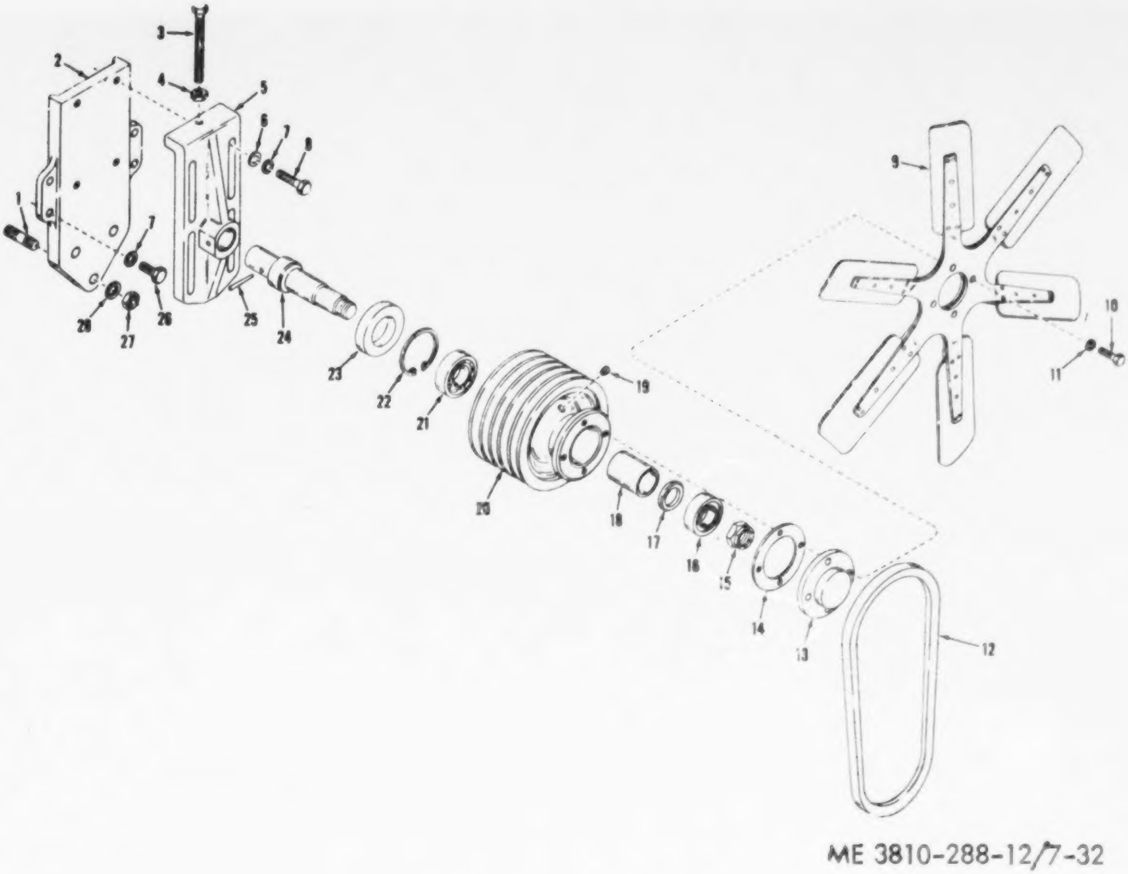

WATER PUMP BELT ADJUSTING SCREW
JAM NUT
WATER PUMP BELTS (2)
IDLER SHEAVE
LONG MOUNTING BOLTS (2)
SHORT MOUNTING BOLTS (2)
WATER PUMP SHEAVE
BELT GUARD
1/2 INCH BELT MOVEMENT HERE
ME 3810-288-12/7-31

Figure 7-31. Water pump belt tension adjustment, and sheave belt, removal and



1. Stud, fan bracket
2. Bracket, fan
3. Bolt, fan belt adjusting
4. Nut, hex
5. Bracket, fan hub
6. Washer, plain
7. Washer, lock
8. Bolts, mounting
9. Fan
10. Screw, cap
11. Washer, lock
12. Belt, fan (3)
13. Spacer, fan
14. Gasket, fan spacer
15. Nut, flex loc
16. Bearing, ball
17. Washer
18. Spacer, ball bearing
19. Plug, pipe, slotted headless
20. Sheave, fan
21. Bearing, ball
22. Ring, retaining
23. Seal, oil
24. Shaft, fan drive
25. Pin, taper
26. Screw, cap, hex head
27. Nut, hex
28. Washer, lock

Figure 7-32. Fan, fan belt, and associated parts, removal and replacement.

(*a*) Refer to figure 7-33, remove the cap nut, and drain the fluid from the hydraulic reservoir into a suitable container.

(*b*) Refer to figure 7-34, loosen the jam nut and back off on the power steering adjusting bolt to relieve power steering pump belt tension. Lift the power steering belt off the belt sheave.

(*c*) Refer to figure 5-3 and disconnect the fitting and hose clamp which secure the lines to the pump and pump reservoir, respectively.

(*d*) Refer to figure 7-35, remove the attaching bolts, nuts, and lockwashers, and remove

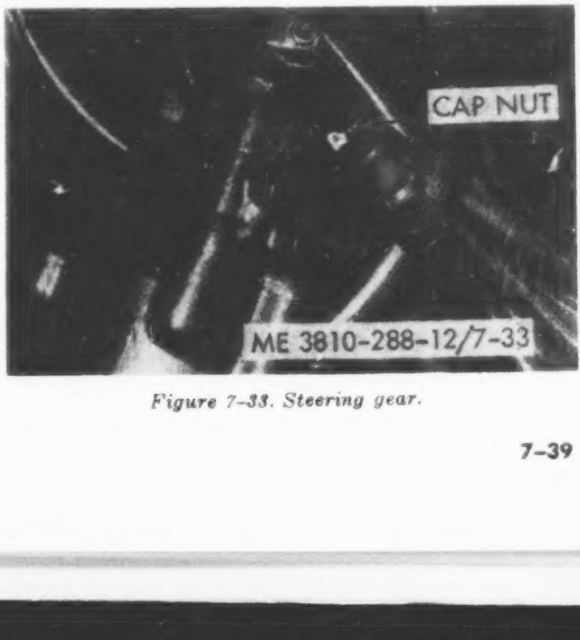


Figure 7-33. Steering gear.

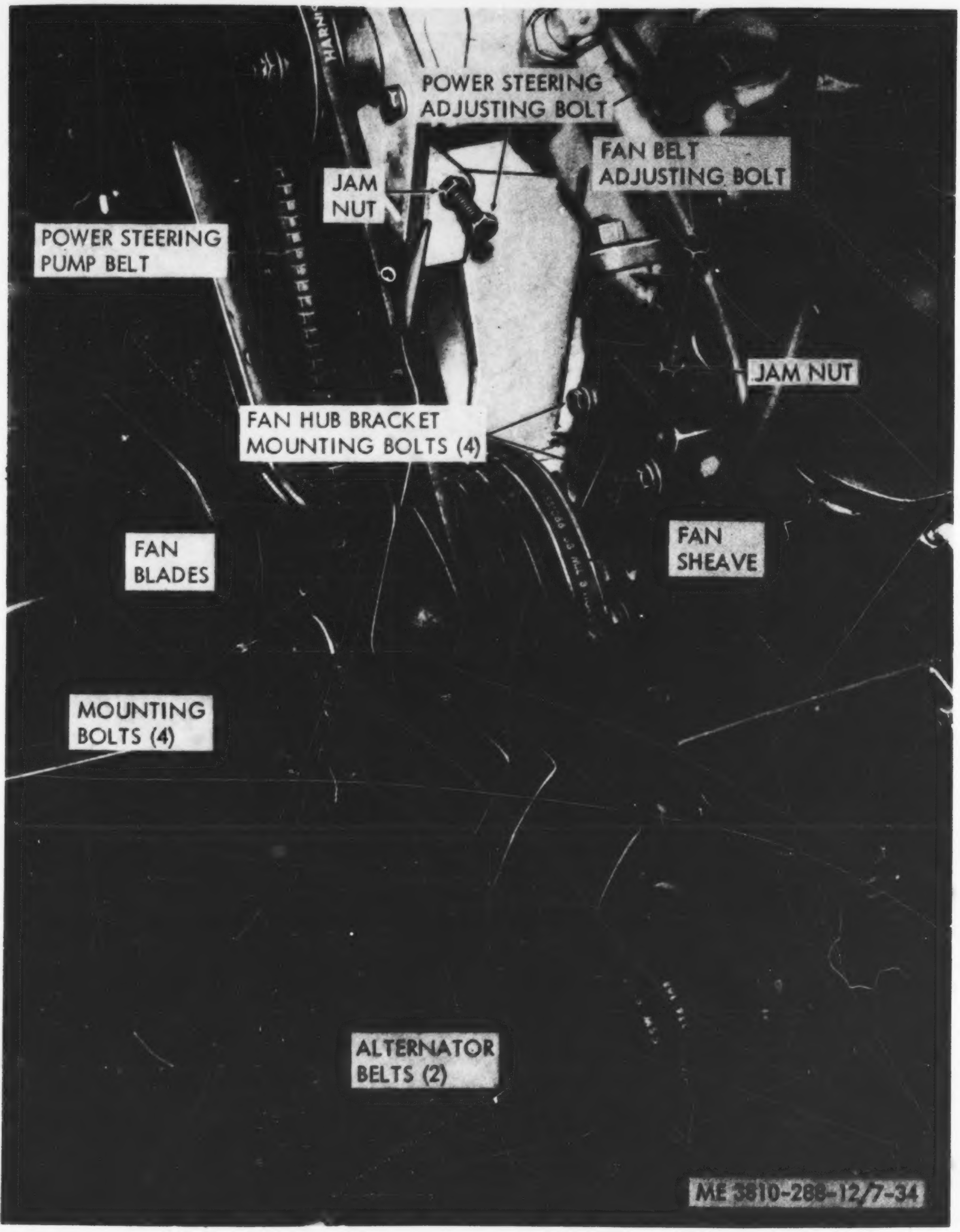

POWER STEERING ADJUSTING BOLT
FAN BELT ADJUSTING BOLT
JAM NUT
POWER STEERING PUMP BELT
JAM NUT
FAN HUB BRACKET MOUNTING BOLTS (4)
FAN BLADES
FAN SHEAVE
MOUNTING BOLTS (4)
ALTERNATOR BELTS (2)
ME 3810-288-12/7-34

Figure 7–34. Power steering pump and belt, removal, adjustment, and installation.

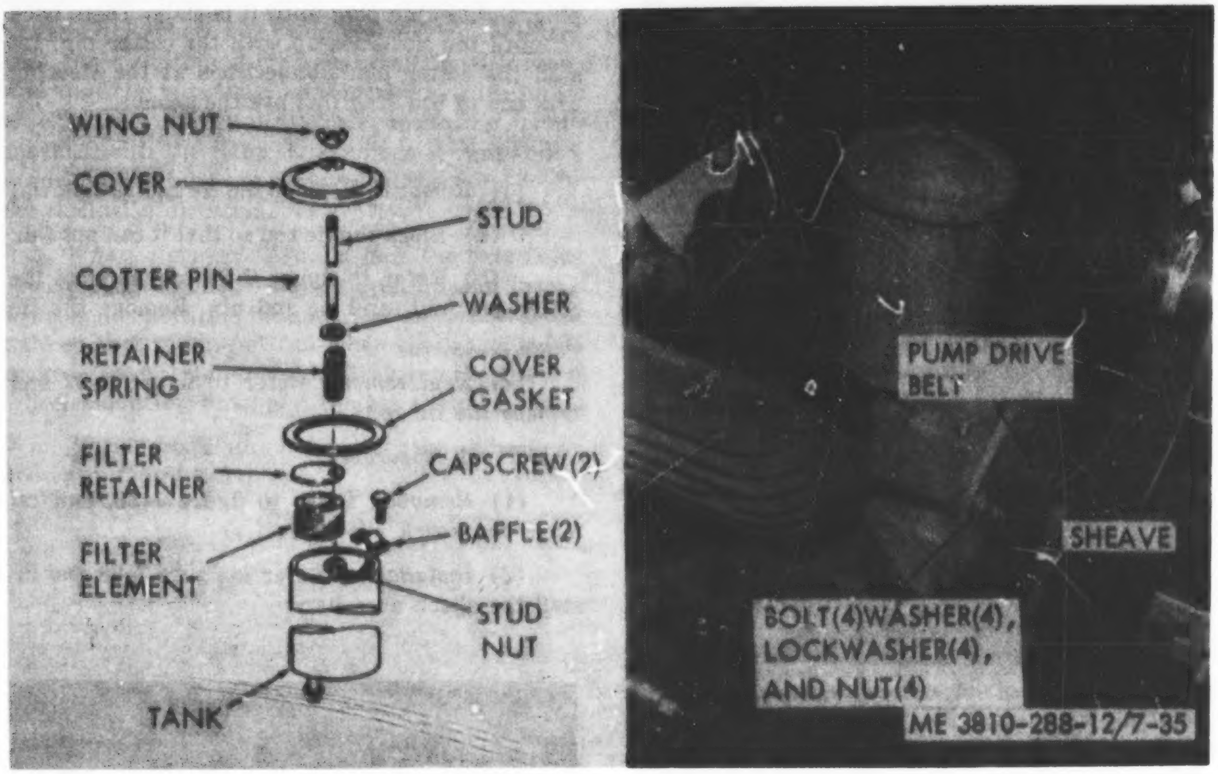

WING NUT
COVER
STUD
COTTER PIN
WASHER
RETAINER SPRING
COVER GASKET
FILTER RETAINER
CAPSCREW(2)
FILTER ELEMENT
BAFFLE(2)
STUD NUT
TANK
PUMP DRIVE BELT
SHEAVE
BOLT(4)WASHER(4), LOCKWASHER(4), AND NUT(4)
ME 3810-288-12/7-35

Figure 7-35. Power steering pump, service and replacement.

the power steering pump-reservoir as an assembly.

(2) *Installation.* Install the power steering pump-reservoir assembly as shown in figures 7-34 and 7-35. When filling the reservoir with clean fluid, one man must pour the fluid into the reservoir while another man installs the cap nut (figure 7-33). In this way, any air trapped in the line will be eliminated. This system can be bled of air simply by turning the steering wheel back and forth a few times, but the above method will eliminate the possibility of much air being trapped in the system.

(3) *Belt tension adjustment.* Refer to figure 7-34, loosen the jam nut, tighten the adjusting bolt, and retighten the jam nut when belt tension will allow a maximum of ½ inch midspan deflection in the power steering pump belt.

(4) *Reservoir replacement.* To replace the reservoir only, refer to the exploded view of the reservoir in figure 7-35. Replace the reservoir as follows:

(*a*) Remove wing nut, cover, and cover gasket.

(*b*) *Remove cotter pin.* Remove the washer, spring, filter retainer, and filter element.

(*c*) Remove the stud nun and the two capscrews which hold the baffles. Remove the reservoir tank from the pump.

(*d*) Install a new reservoir as shown in figure 7-35.

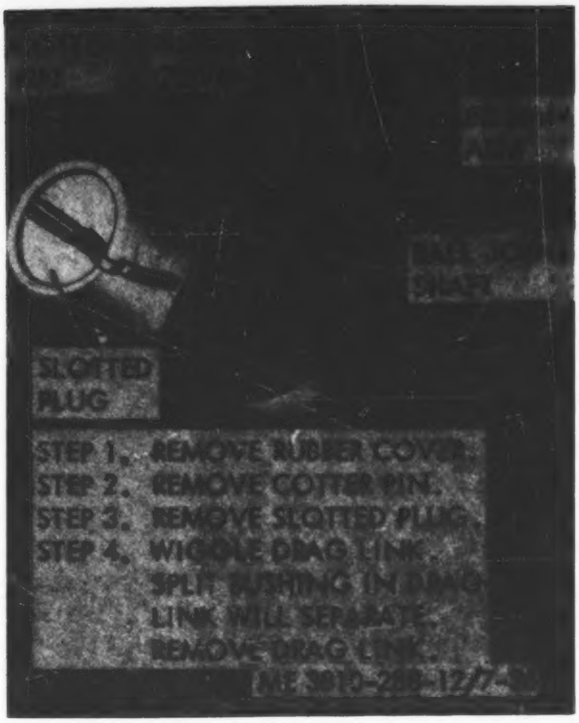
Note. Be sure that the filter element is over the reservoir inlet port.

c. Hoses, Lines, and Fittings. Refer to figure 5-3 and remove or replace a defective hydraulic steering system hose, line, or fitting.

d. Steering Wheel. Replacement of the steering wheel is covered under the topic Horn Button Removal. Refer to paragraph 7-41*i* and remove or replace the steering wheel.

e. Drag Link.

(1) *Removal.* Refer to figure 7-36 and remove the drag link.



STEP 1. REMOVE RUBBER COVER.
STEP 2. REMOVE COTTER PIN.
STEP 3. REMOVE SLOTTED PLUG.
STEP 4. WIGGLE DRAG LINK. SPLIT BUSHING IN DRAG LINK WILL SEPARATE. REMOVE DRAG LINK.

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Figure 7-36. Drag link, removal and replacement.

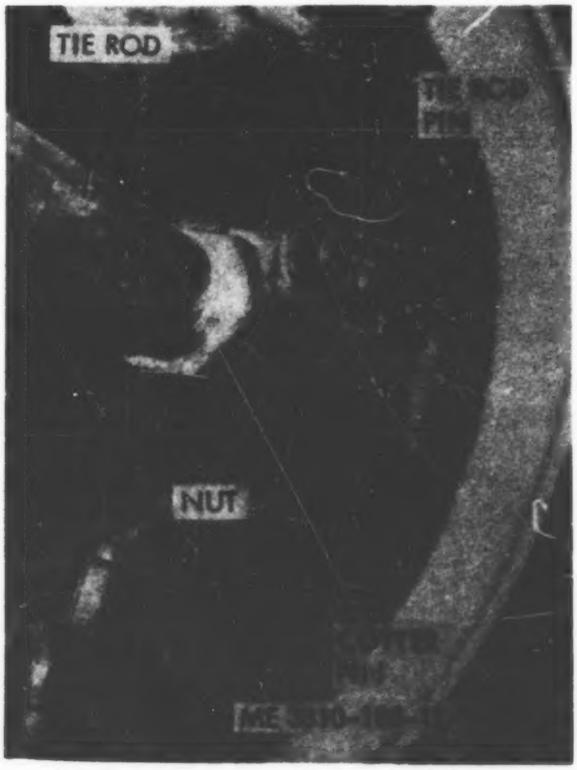


Figure 7-37. Tie rod, removal and replacement.

(2) *Installation.* Refer to figure 7-36 and install the drag link. When tightening slotted plug, tighten the plug until it is snug. Then, back off until the slot lines up with the cotter pin. Install the cotter pin. Connections at the steering arm end of the drag link are the same.

f. Tie Rod.

(1) *Removal.* Remove the tie rod as follows:

(*a*) Block the tie rod so that it can not fall.

(*b*) Refer to figure 7-37 and remove the cotter pin, nut, and tie rod pin. Remove the tie rod.

(2) *Replacement.* Refer to figure 7-37 and replace the tie rod.

g. Shock Absorbers.

(1) *Removal.* Refer to figure 7-38, and remove the shock absorbers.

(2) *Installation.* Refer to figure 7-38 and install the shock absorbers.

STEP 1. REMOVE NUTS.
STEP 2. REMOVE WASHERS.
STEP 3. REMOVE SHOCK ABSORBERS AND RUBBER [illegible]

Figure 7-38. Shock absorbers, removal and replacement.

7-45. Wheels, Tires, and Tubes

a. General. Figure 7-39 shows a typical left wheel. Note that the letter L is stamped on the ends of the wheel mounting studs. This indicates that the mounting studs have a left hand thread, and that the nuts must be removed by turning in a clockwise direction. Wheel mounting studs marked with the letter R are normal right hand studs and the nuts are removed in the usual counter-clockwise direction.

b. Wheel Removal. Always jack the axle from which the wheel is to be removed up and install firm, solid blocking beneath the axle. Block the axle so that it can not fall when the wheel is removed. Then, refer to figure 7-39 remove the ten wheel mounting nuts, and remove the wheel.

c. Wheel Installation. Install the wheel as shown in figure 7-39.

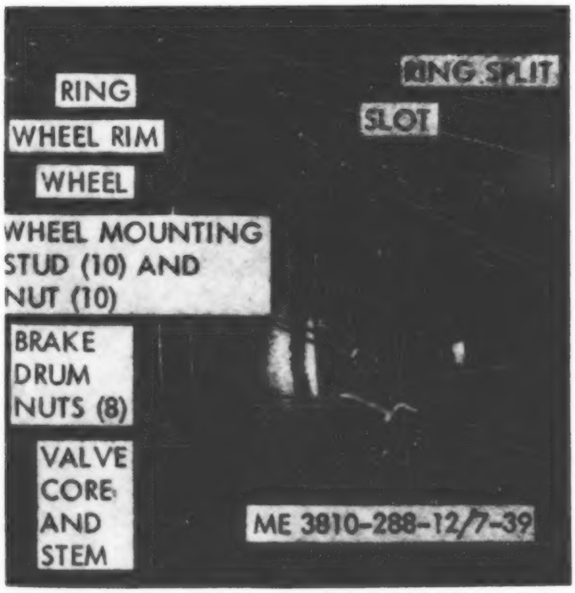


Figure 7-39. Tires and wheels, removal and installation.

d. Tire and Tube Removal. Remove the wheel as instructed above. Then proceed as follows:

(1) Remove the valve core from the valve stem and be sure all air is allowed to escape from the tire.

***Caution:* Air in the tire can cause serious injury to personnel attempting to remove tires from wheels.**

(2) Using a suitable hammer, preferably at least 5 pounds in weight, strike the tire at points near the ring, until the ring breaks loose from the tire. Start at the ring split, and work around the ring.

(3) Insert a suitable tool in the slot in the ring and pound the ring in at a point 180 degrees from the ring split while prying out at the ring-slot. Pry until the ring is loosened and projects above the wheel rim. Then pry the ring out of the rim, proceeding progressively around the ring from the slot.

(4) Using the hammer used to remove the ring, break the tire bead loose from the wheel. Then turn the wheel over and break the tire bead loose from the wheel at the other side. Remove the wheel from the tire.

(5) Remove the flap (a circular piece of flat rubber-like material which fits around the inside of the inner tube) and the inner tube from the tires.

(6) Inflate the tube, place it in water to locate the leak by means of escaping air bubbles, and patch the leak using either hot or cold patches.

e. Tire and Tube Installation. Install the tire and tube on the wheel as follows:

(1) Place the inner tube in the tire and install the flap beneath the tube. The flap will protect the tube from damage while the tire-tube assembly is placed on the wheel.

(2) Place the wheel inside the tire, with the opening in the wheel lined up with the tube valve stem. The wheel will be off-center in relationship to the tire, with the stem opening closest to the stem. Insert the valve stem through the wheel and place the valve stem cover on the stem to prevent the stem from coming out of the wheel.

(3) Center the wheel in the tire.

(4) Using a suitable tool, starting at the ring split, force the ring into place around the edge of the wheel rim.

Note. It is very important that all rust, corrosion, and accumulated dirt be removed from the ring and its seating surface on the wheel rim.

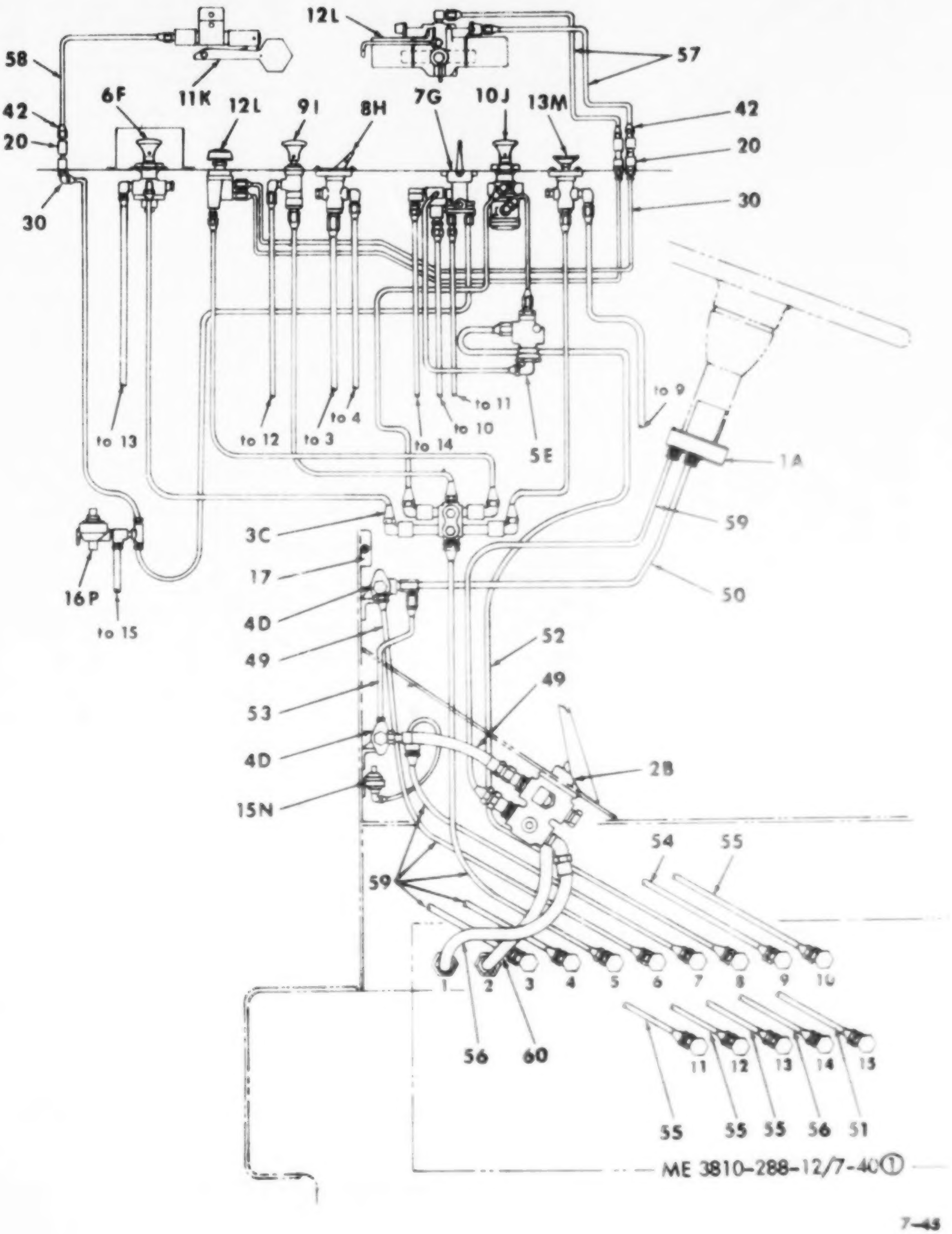
(5) With the ring installed, turn the tire over, so that the ring side is touching the ground. Using an air hose from the side opposite the ring, inflate the tire.

Warning: **Always inflate the tire from the side opposite the ring. If the ring is improperly installed, air pressure may cause it to fly off the wheel, and serious injury to personnel may result.**

(6) Install the wheel-tire on the vehicle.

7-46. Air Brake System

a. General. Figure 7-40 is a piping diagram of the air brake system for the entire carrier. It also includes the windshield wiper motor and the low air pressure alarm, since these items are tied into the air system. All items are located on the drawing in relationship to their location on the machine. However, the items contained in the gauge board in the operator's cab are turned 90 degrees. If this were not done, all of the gauge board mounted items would be seen from the side, and would hide each other. The fifteen air connections which enter the operators cab as shown in part 1 of the illustration are connected to like numbered connections on sheet 2, which is the forward end of the carrier. Items identified by both a number and a letter of the alphabet (for example 3*c*) indicate that a detailed view of that item is to be found on the last sheet of figure 7-40.


12L
58
57
11K
42
20
6F
12L
9I
8H
7G
10J
13M
42
20
30
30
to 9
to 11
to 10
to 13
to 12
to 3
to 4
to 14
5E
1A
3C
59
16P
to 15
17
50
4D
49
52
53
49
4D
2B
15N
54
55
59
1
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7
8
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56
60
11
12
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14
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55
56
51

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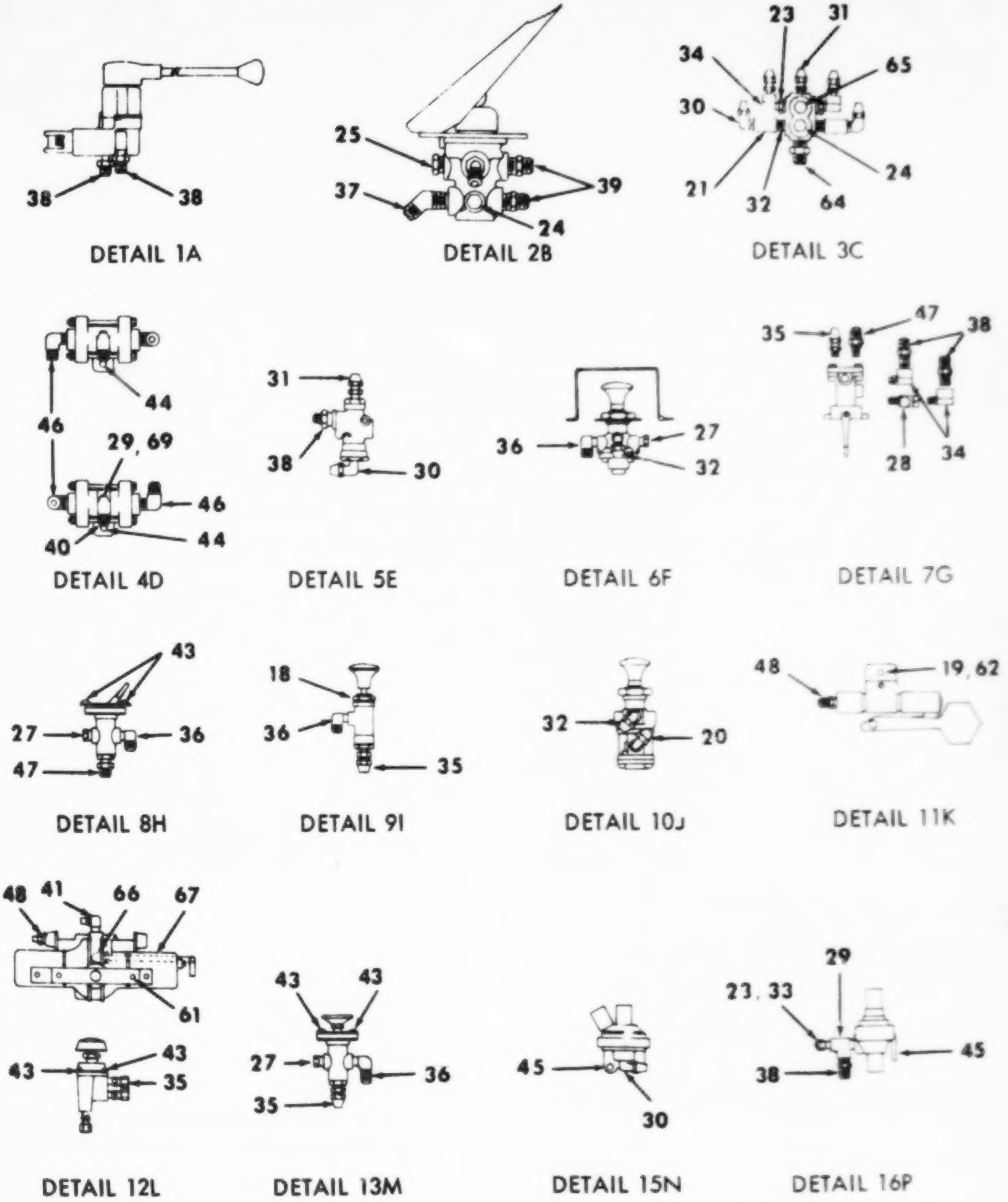
Key to fig. 7:40:

1. Valve, brake
2. Valve, treadle
3. Manifold, air
4. Valve, double check
5. Valve, SV-1
6. Valve, PP-1
7. Control valve, three-way
8. Control valve, TW-1
9. Drain Valve, HV-4
10. Control valve, PP-3
11. Indicator, flag
12. Wiper, windshield
13. Valve, differential lockout
14. Buzzer
15. Switch, stop light
16. Switch, low pressure indicator
17. Tube
18. Spacer, standard pipe
19. Spacer, standard pipe
20. Quick disconnect
21. Coupling, pipe
22. Nipple, close
23. Bushing, reducing
24. Plug, brass, pipe
25. Plug, galvanized, pipe
26. Grommet
27. Plug, brass, pipe
28. Tee, adapter
29. Tee, street
30. Elbow
31. Connector
32. Tee
33. Tee
34. Elbow, 90°
35. Connector
36. Elbow, 90°
37. Elbow, 45°
38. Connector, male
39. Connector, male
40. Elbow, male
41. Elbow, male
42. Connector, male
43. Machine screw, round head, with lockwasher and nut
44. Machine screw, round head, with lockwasher and nut
45. Capscrew, hex head, with lockwasher and nut
46. Elbow, 90°
47. Connector, male
48. Connector, male
49. Hose assembly
50. Hose assembly
51. Hose assembly
52. Hose assembly
53. Hose assembly
54. Hose assembly
55. Hose assembly
56. Hose assembly
57. Hose assembly
58. Hose assembly
59. Hose assembly
60. Hose assembly
61. Machine screw, round head, with lockwasher
62. Machine screw, round head, with lockwasher and nut
63. Cover, valve
64. Connector, male
65. Sending unit, air pressure
66. Elbow, male, 90°
67. Tube
68. Machine screw, round head, with nut and lockwasher
69. Bushing, reducing
70. Horn, air
71. Coupling, hose (service)
72. Coupling hose (emergency)
73. Coupling, dummy
74. Coupling, dummy
75. Tag, service
76. Tag, emergency
77. Cutout cock
78. Valve, check
79. Valve, drain
80. Valve, safety
81. Valve, double check
82. Reservoir, air
83. Quick disconnect
84. Evaporator, alcohol
85. Valve, limit and quick release
86. Valve, pressure protection
87. Nipple, hex pipe
88. Valve, control
89. Valve, non-charging
90. Reservoir, air
91. Valve, tractor protection
92. Fitting, manifold
93. Tee, frame
94. Valve, check
95. U-bolt
96. Clamp, tube
97. Clamp, tube
98. Nipple, hex pipe
99. Machine screw, round head, with nut and lockwasher
100. Elbow, 90°
101. Bushing, reducing
102. Coupling, anchor
103. Coupling, anchor
104. Clamp, tube
105. Spring, hose
106. Clip, spring
107. Clip, spring
108. Stud, clamping
109. Line, compressor discharge
110. Hose assembly
111. Hose assembly
112. Hose assembly
113. Hose assembly
114. Plug, pipe
115. Bushing, reducing
116. Bushing, reducing
117. Bushing, reducing
118. Elbow, 45°
119. Adapter, tee
120. Tee
121. Elbow, 90°
122. Tee, union
123. Tee
124. Elbow, 90°
125. Elbow, 90°
126. Elbow, 90°
127. Elbow, 90°
128. Connector
129. Connector
130. Connector
131. Elbow, street
132. Elbow, street
133. Bushing, reducing
134. Connector, tube
135. Machine screw, round head, with lockwasher and nut
136. Machine screw, round head, with lockwasher and nut
137. Capscrew, hex head, with nut and lockwasher
138. Capscrew, hex head, with nut and lockwasher
139. Tube
140. Tube
141. Tube
142. Tube
143. Tube
144. Tube
145. Tube
146. Tube
147. Tube
148. Tube
149. Tube
150. Tube
151. Tube
152. Tube
153. Tube
154. Tube
155. Tube
156. Tube
157. Capscrew, hex head, with nut and lockwasher
158. Tube
159. Tube
160. Loom
161. Loom
162. Loom
163. Loom
164. Loom
165. Capscrew, hex head, with lockwasher and nut
166. Elbow, street
167. Connector
168. Plug, pipe, hex head
169. Nut, hex with lockwasher
170. Connector, female
171. Tee, male run
172. Tee, male run
173. Coupling, pipe
174. Connector, male
175. Elbow, male
176. Elbow, male
177. Elbow, male
178. Tube
179. Tube
180. Coupling, pipe
181. Pipe nipple, close
182. Connector
183. Union, tube
184. Connector
185. Plug, dust, male
186. Elbow, 90°
187. Tube
188. Connector
189. Adapter, tee
190. Connector, male
191. Plug, pipe, hex head
192. Elbow, street
193. Tube
194. Loom
195. Connector, male
196. Nut, hex with lockwasher
197. Elbow, street

Figure 7-40. Air brake system piping diagram, valves, hoses and fittings, removal and replacement. (Sheet 1 of 3)

Figure 7-40. Air brake system piping diagram, valves, hoses and fittings, removal and replacement. (Sheet 2 of 3) See sheet 1 of 3 for key.

(Located in back of manual)


38
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DETAIL 1A
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DETAIL 2B
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DETAIL 3C
44
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29, 69
46
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DETAIL 4D
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DETAIL 5E
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DETAIL 6F
35
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28
34
DETAIL 7G
43
27
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DETAIL 8H
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35
DETAIL 9I
32
20
DETAIL 10J
48
19, 62
DETAIL 11K
48
41
66
67
61
43
43
35
DETAIL 12L
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43
27
36
35
DETAIL 13M
45
30
DETAIL 15N
29
23, 33
38
45
DETAIL 16P

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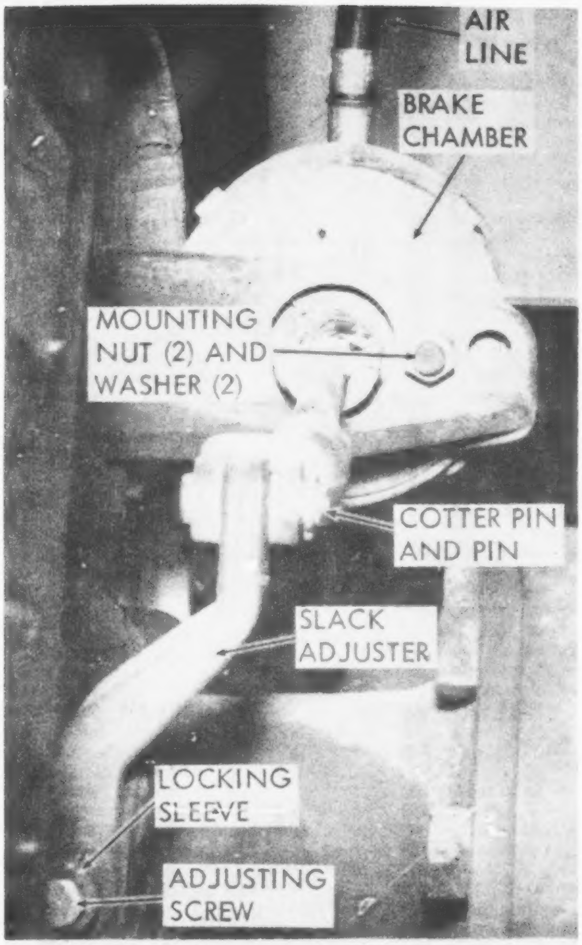
Figure 7-40. Air brake system piping diagram, valves, hoses and fittings, removal and replacement. (Sheet 3 of 3) See sheet 1 of 3 for key.



STEP 1. REFER TO FIGURE 7-1 AND RELEASE ALL AIR BRAKE PRESSURE.

STEP 2. REMOVE SLACK ADJUSTER COTTER PIN AND PIN.

STEP 3. UNSCREW AIR LINE CONNECTION TO REAR OF BRAKE CHAMBER AT SWIVEL CONNECTION.

STEP 4. REMOVE MOUNTING NUTS AND WASHERS.

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Figure 7-41. Front wheel brake chamber, removal and replacement.

b. Valves, Hoses, and Fittings. Refer to figure 7-40 and remove and install a defective valve, hose, or fitting. No repair is possible for hoses or fittings, except those described under Field Expedient Repairs, paragraph 7-37.

c. Front Brake Chambers.

(1) *Removal.* Refer to figure 7-41 and remove the front wheel brake chamber.

(2) *Installation.* Refer to figure 7-41 and install the front wheel brake chamber.

d. Rear Brake Chambers.

(1) *Removal.* Refer to figure 7-42 and remove the rear wheel brake chamber.

(2) *Installation.* Refer to figure 7-42 and install the rear wheel brake chamber.

e. Alcohol Evaporator.

(1) *General.* The purpose of the alcohol evaporator is to permit vaporized alcohol to be drawn into the air brake piping. This vapor prevents any possibility of loss of braking action due to freezing of water vapor in the system components. The device consists of a casting which forms a support for the reservoir, as shown in figure 7-43. Ordinary methyl alcohol is used in the system. In operation, the compressor maintains a partial vacuum in the compressor intake manifold, and the line from the alcohol evaporator to the intake manifold also has a partial vacuum. This vacuum is the reason alcohol vapors enters the system.

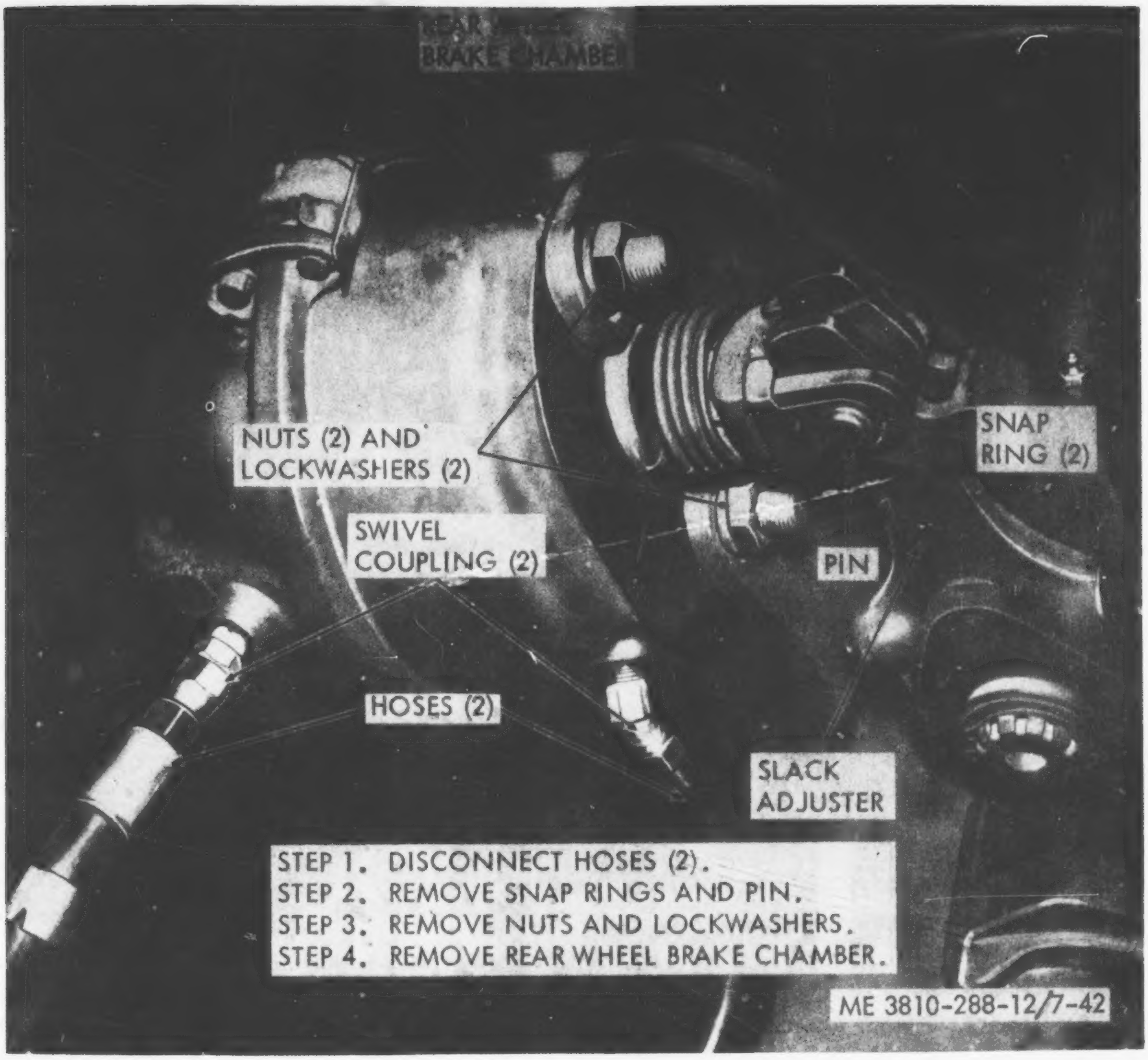
(2) *Removal.* Disconnect the lines to the evaporator and remove the nuts and lockwashers which secure the evaporator cap. Unscrew the cap from the reservoir to disassemble.

(3) *Repair.* To determine if the evaporator is operating properly, start the carrier engine and check to see if air bubbles pass through the alcohol in the reservoir. If bubbles are seen passing through the reservoir, the evaporator is operating properly. If no bubbles are present, remove the alcohol evaporator as previously instructed in this paragraph. Then, repair the alcohol evaporator as follows:

(*a*) Remove the strainer in the evaporator cap and clean thoroughly, using a suitable solvent.

(*b*) Replace the filler cap gasket and the cap gasket.

(*c*) Check to see that both lines to the evaporator are tight at the end where they are



STEP 1. DISCONNECT HOSES (2).
STEP 2. REMOVE SNAP RINGS AND PIN.
STEP 3. REMOVE NUTS AND LOCKWASHERS.
STEP 4. REMOVE REAR WHEEL BRAKE CHAMBER.

Figure 7-42. Rear wheel brake chamber, removal and replacement.

attached to the compressor intake manifold and the compressor governor.

(4) *Installation.* Refer to figure 7-43 and install the alcohol evaporator. Be sure lines to the evaporator are secure, and check to see that air bubbles can be seen passing through the evaporator when the compressor is compressing air. To do so, remove filler cap.

f. Air Reservoirs.

(1) *General.* The only reason for removing or replacing a reservoir normally will be puncture of the reservoir from an outside source. There is no reasonable possibility of corrosion or other external damage so long as the reservoir is kept properly painted. Refer to TM 9-213 for painting information. However, when possible to do so without placing the machine out of operation for an extended period of time, it is recommended that the reservoirs be completely drained by removing the lowest hose connection and allowing all air, water, sediment, and oil trapped in the tank to drain.

(2) *Removal.* Refer to figure 7-44, disconnect all air lines, and remove the air reservoir. There are three air reservoirs used on this ma-

ALCOHOL LINES
RESERVOIR
FILLER CAP
ME 3810-288-12/7-43

Figure 7-43. Alcohol evaporator, removal, repair, and replacement.

chine, and the removal and replacement procedures for all are basically the same.

(3) *Installation.* Refer to figure 7-44 and install an air reservoir.

g. Air Compressor.

(1) *General.* The air compressor is lubricated by oil from the engine system and cooled by water from the engine system. Therefore, lubrication and cooling depend upon proper lubrication and cooling for the engine. Intake air is taken from the clean air side of the engine air cleaner.

(2) *Adjustment.* The governor should be adjusted so that it starts compressing air when pressure drops to 105 psi and stops compressing air when pressure reaches 125 psi. To adjust, proceed as follows:

(*a*) Start the engine and build up air pressure in the air brake system. Check the gauge pressure at the cab air pressure gauge (fig. 6-1) at the time the governor cuts off compression. Pressure should be 125 psi.

STEP 1. DISCONNECT ALL HOSES AND LINES AT THE SWIVEL FITTINGS.

STEP 2. REMOVE AIR RESERVOIR BY REMOVING ATTACHING HARDWARE.

STEP 3. REMOVE ALL FITTINGS, VALVES, AND TEES FROM THE OLD TANK AND INSTALL THEM IN NEW TANK.

STEP 4. INSTALL NEW TANK WITH FITTINGS REMOVED FROM OLD.

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Figure 7-44. Air reservoirs, removal and replacement.

(*b*) With the engine still running, make a series of brake applications to reduce reservoir air pressure. Note the pressure at which the governor starts the compressor. This pressure should be 105 psi. Before adjusting, it is recommended that the gauge board pressure gauge be checked with an accurate independent gauge, if one is available.

(*c*) Remove the governor cover (fig. 7-46)

(*d*) Refer to figure 7-46 and loosen the adjusting screw locknut. With a screwdriver, turn the adjusting screw counterclockwise (viewed from above) to raise the pressure settings. Turn the screw clockwise to lower the pressure settings. Both the starting and stopping pressure settings will change by an approximately equal amount.

NUT (2)
LOCKWASHER (2)
COMPRESSOR
DRIVE
SHEAVE
DISCHARGE
AIR LINE
ALCOHOL
EVAPORATOR
LINES
INTAKE
MANIFOLD
SWIVEL
FITTING
BOLT (2)
LOCKWASHER (2)

Figure 7-45. Air compressor, removal and replacement. (Sheet 1 of 2)

(*e*) Recheck the starting and stopping points of the compressor as described above. Then tighten the adjusting screw locknut. Install the governor cover.

(3) *Removal.* Remove the air compressor as follows:

(*a*) Refer to figure 7-34 and release fan belt tension. Lift the belts off the compressor drive sheave.

(*b*) Refer to figure 7-45 and disconnect the two alcohol evaporator lines, which go to the air compressor intake manifold and governor, at the swivel fittings.

(*c*) Remove the compressor discharge air line by removing the attaching nuts and lockwashers.

(*d*) Remove the compressor intake air line by removing the attaching bolts and lockwashers.

(*e*) Refer to figure 7-45 and disconnect the oil line to the compressor.

(*f*) Refer to figure 7-45 and disconnect the water lines to the compressor at the swivel fittings.

(*g*) Remove the compressor mounting bolts and lockwashers and remove the air compressor.

(4) *Installation.* Install the air compressor as illustrated in figure 7-45. Replace all gaskets, and check governor adjustment as described in this paragraph before returning the machine to service. Check all water, air and oil lines to be sure there are no leaks. Refer to figure 7-34 and adjust the fan belt tension, since the fan belts also drive the compressor.

h. Dummy Couplings.

(1) *General.* Trailer dummy couplings (fig.

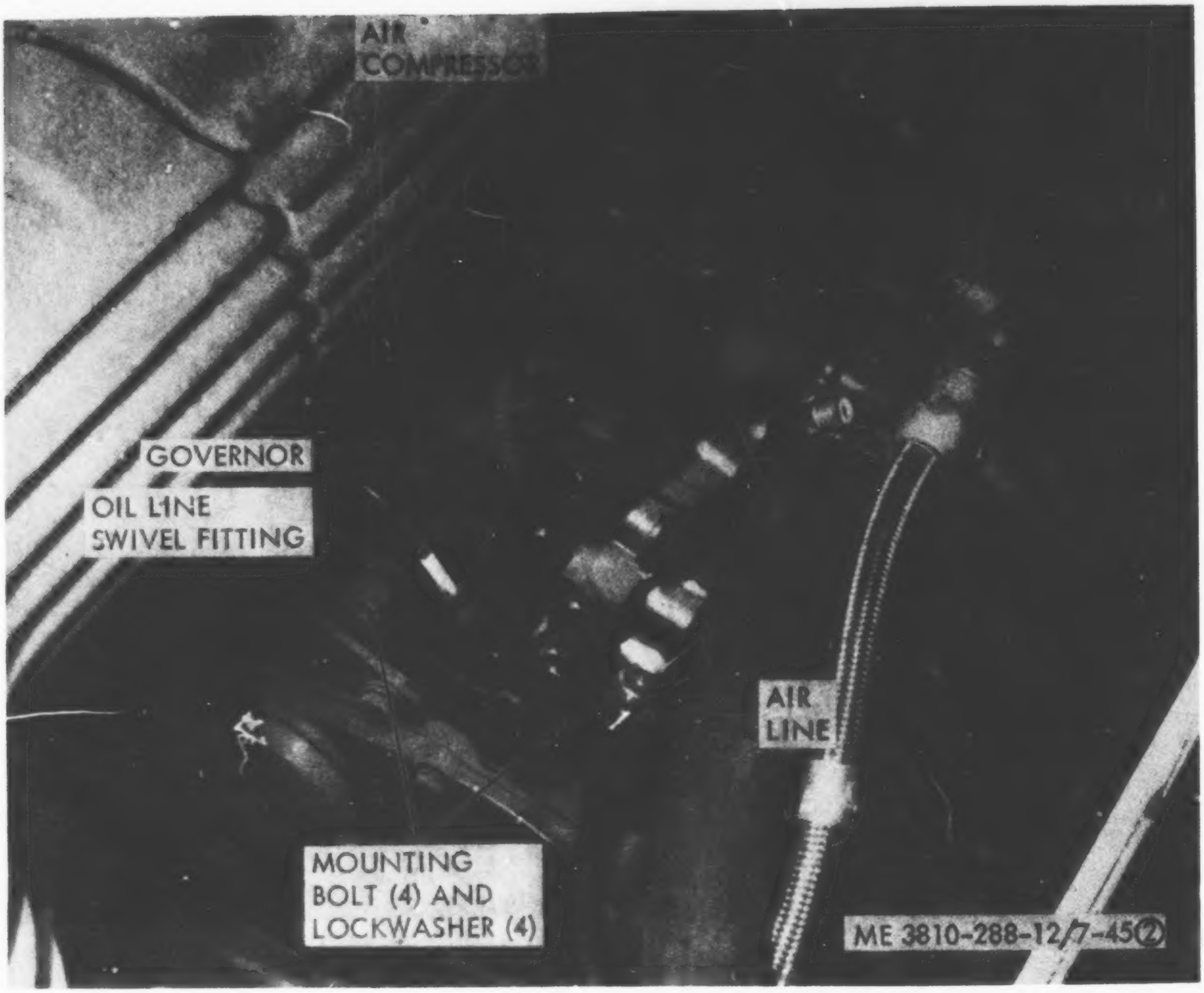
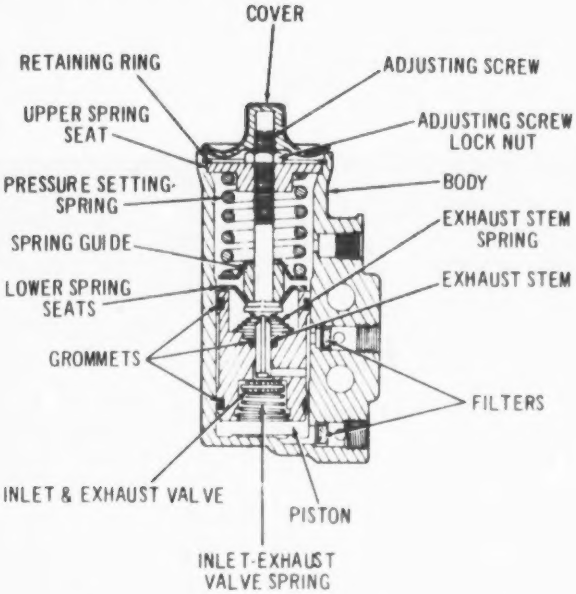


Figure 7-45. Air compressor, removal and replacement. (Sheet 2 of 2)

7-47) are provided both at the front of the carrier and at the rear. In addition, couplings are located between the rear of the carrier to provide a "jumper" connection between the carrier and the rear of the outrigger box. The dummy couplings are used to connect the truck crane to another vehicle, similarly equipped. The truck crane can tow another vehicle when the other vehicle is attached to the rear pintle hook and when the dummy couplings are connected to the towed vehicle. The truck crane can be towed by another vehicle when the front pintle hook is mechanically connected to the other vehicle and the dummy couplings are connected to the towing vehicle. Figure 7-47 shows a check valve and an ordinary on-off valve, both of which are used only at the front of the truck crane, in the "Emergency" circuit. Note that the on-off valve is shown in the off position, and should remain in that position, except when the truck crane is being towed.

(2) *Removal and replacement.* To remove dummy couplings, disconnect the air lines at the swivel fittings, figure 7-47, unscrew mounting nuts on each side of the bracket, and remove the dummy coupling.



ME 3810-288-12/7-46

Figure 7-46. Air compressor governor adjustment.

i. Service Brakes.

(1) *Adjustment.* Adjustment of all service brakes is the same, regardless of which wheel is involved. Adjust service brakes as follows:

(*a*) Jack up the wheel at which the brake is to be adjusted so that it does not contact the ground.

(*b*) Spin the wheel and keep it spinning through step (*c*) below.

(*c*) Refer to figure 7-41, push in the locking sleeve and turn the adjusting screw until the brake shoe just makes contact with the brake drum. This point will be apparent, since this is the point at which the wheel will slow down. Use an open end or socket wrench to turn the adjusting screw and hold the locking sleeve in as far as it will go.

(*d*) Back off on the adjusting screw until the wheel just turns freely. Allow the locking sleeve to return to the upper (locking) position in order to maintain the adjustment just made.

(2) *Brake shoe removal.* Remove brake shoes as follows:

(*a*) Jack up the axle on the side of the wheel to be worked on, and block the axle so that the wheel is supported off the ground. Be sure the machine is adequately blocked to prevent tipping.

(*b*) Refer to figure 7-39 and remove the wheel. Remove the brake drum nuts shown in the illustration and remove the brake drum.

(*c*) Refer to figure 7-48, remove the shoe return spring, remove the "C" washers from guide pins and anchor pins, and remove the brake shoes.

(3) *Brake shoe installation.* Refer to figure 7-48 and install brake shoes.

j. Windshield Wiper.

(1) *Motor replacement.* Figure 7-49 shows the location of the windshield wiper motor. Before replacing a wiper motor which is apparently not operating properly, check system air pressure. Air pressure in the reservoir which supplies the wiper motor must be above 95 psi, or there will be no air available for running the wiper motor, since this is a low air condition. To remove the wiper motor, remove the wiper arm nut, disconnect the two air supply lines and the vent line, remove the motor bolts, and remove the wiper motor.

(2) *Blade replacement.* Refer to figure 7-49, remove the blade nut, and replace the windshield wiper blade.

k. Low Air Pressure Valve. Figure 7-49 shows the position of the low air pressure valve when air pressure is below safe operating pressure. To remove the low air pressure valve, disconnect the air line and remove the attaching nut and washer.

7-47. Engine Manifold

a. Intake Manifold.

(1) *Inspection.* Inspect the intake manifold for loose nuts, leaks, cracks, or other physical damage.

(2) *Replacement.* Refer to figure 7-50 and remove and replace the intake manifold.

(3) *Repair.* Repair the intake manifold by replacing any damaged intake manifold components. Refer to figure 7-50 and replace any damaged intake manifold component.

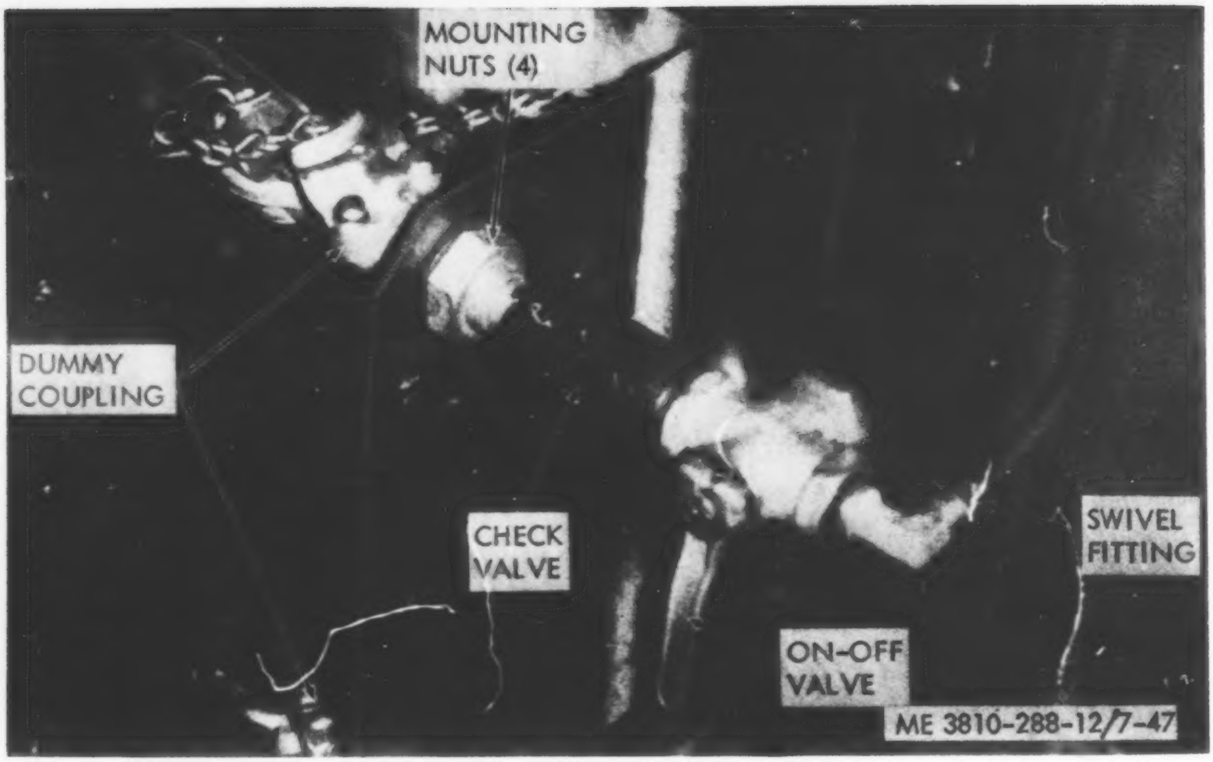

MOUNTING NUTS (4)
DUMMY COUPLING
CHECK VALVE
SWIVEL FITTING
ON-OFF VALVE
ME 3810-288-12/7-47

Figure 7-47. Dummy couplings, removal and replacement.

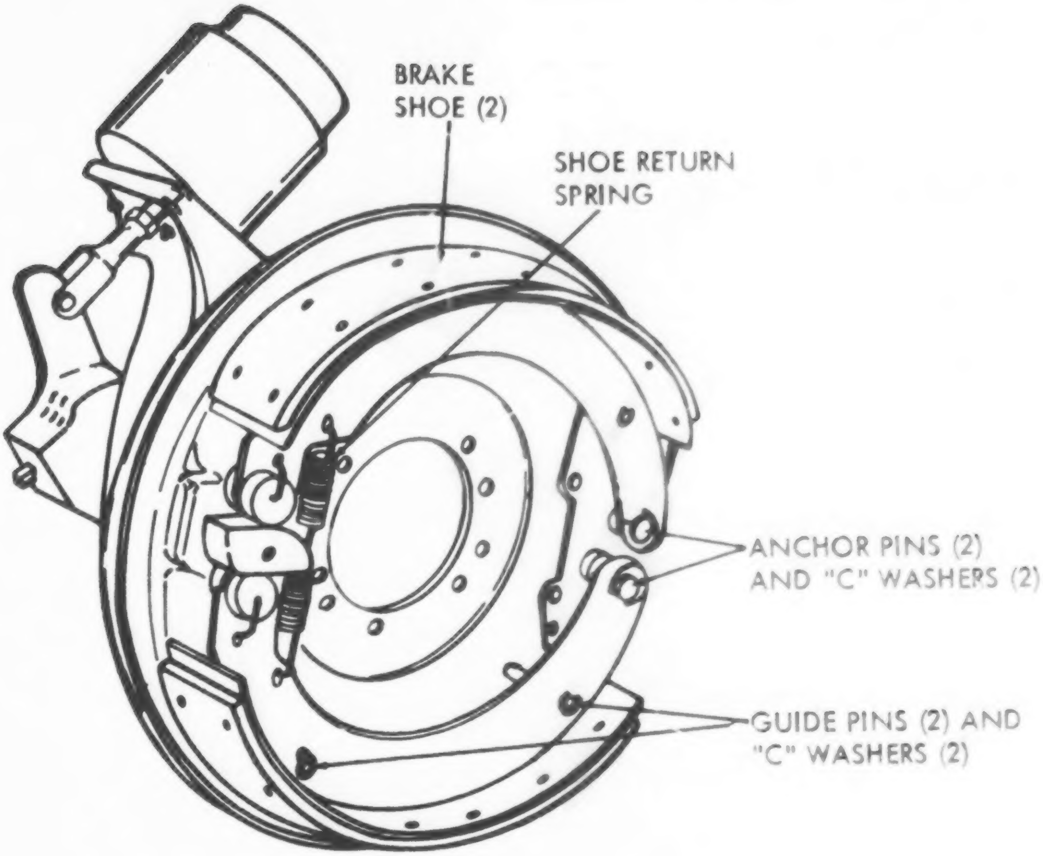

BRAKE SHOE (2)
SHOE RETURN SPRING
ANCHOR PINS (2) AND "C" WASHERS (2)
GUIDE PINS (2) AND "C" WASHERS (2)
ME 3810-288-12/7-48

Figure 7-48. Brake shoes, removal and replacement.

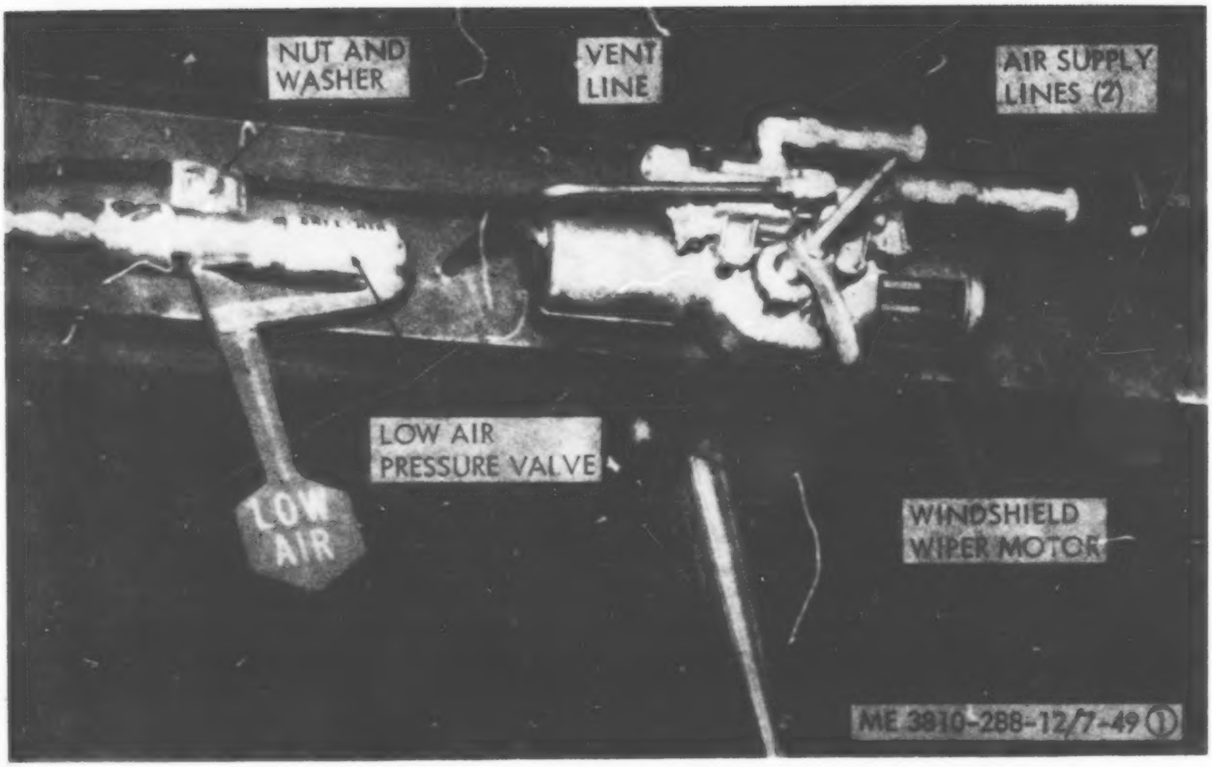

NUT AND WASHER
VENT LINE
AIR SUPPLY LINES (2)
LOW AIR PRESSURE VALVE
LOW AIR
WINDSHIELD WIPER MOTOR
ME 3810-288-12/7-49 ①

Figure 7-49. Windshield wiper motor, removal and replacement. (Sheet 1 of 2)

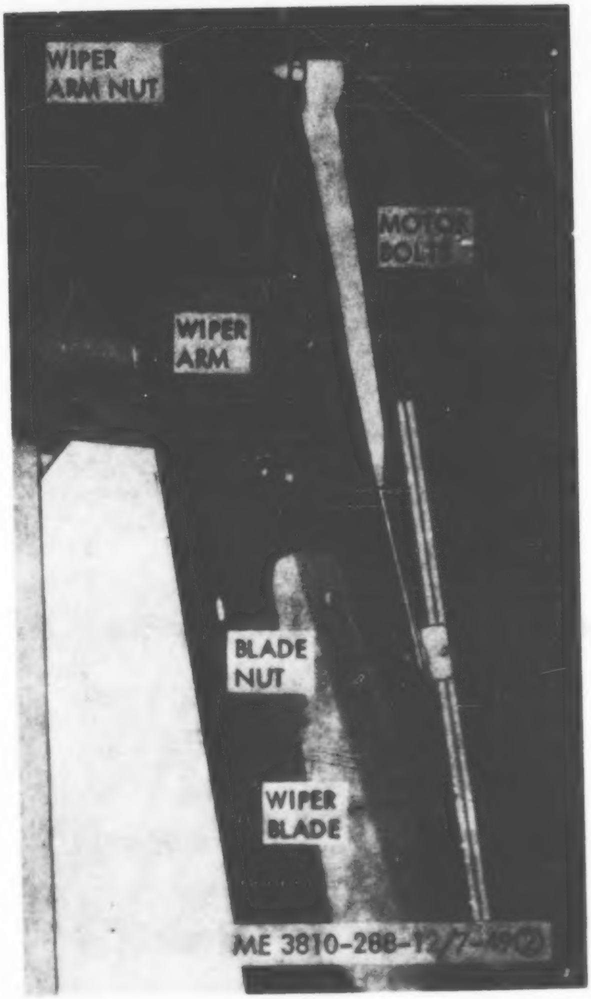


Figure 7-49. Windshield wiper motor, removal and replacement. (Sheet 2 of 2)

b. *Exhaust Manifold.*

(1) *Inspection.* Inspect the exhaust manifold for loose nuts, leaks, cracks, or other physical damage.

(2) *Replacement.* Refer to figure 7-51 and remove and replace the exhaust manifold.

(3) *Repair.* Repair the exhaust manifold by replacing any damaged exhaust manifold components. Refer to figure 7-51 and replace any damaged exhaust manifold components.

7-48. Exhaust Pipe and Muffler

Refer to figure 7-52 and remove and replace the exhaust pipes and muffler.

7-49. Engine Compression Test

Test the engine compression as follows:

a. Blow all foreign material from around the spark plugs with compressed air. Loosen all spark plugs one turn. Start the engine and run at a fast idle for a few minutes.

b. Stop the engine and remove all the spark plugs. Refer to figure 7-15 and disconnect the air cleaner hose from the carburetor intake. Refer to figure 6-1 and pull the throttle control out fully.

c. Insert a compression gage firmly in a spark plug opening and crank the engine through four or five compression strokes with the starter. Read the amount of compression on the gage.

d. Repeat the above step for the remaining cylinder. The compression gage reading for all the cylinders should be between 125 and 145 psi (pounds per square inch). If the compression of any cylinder does not fall within this range, report the deficiency to General Support Maintenance.

7-50. Engine Rocker Arm-Tappet Adjustment

a. General. The tappets on this engine are to be adjusted when the engine has set idle for a period of time so that it has cooled to the temperature of the surrounding air. They can not be accurately set if the rocker arms are hollowed out by contact with the valve pushrods. If inspection reveals hollowed out rocker arms, report the condition to proper authority.

b. Adjustment. Adjust as follows:

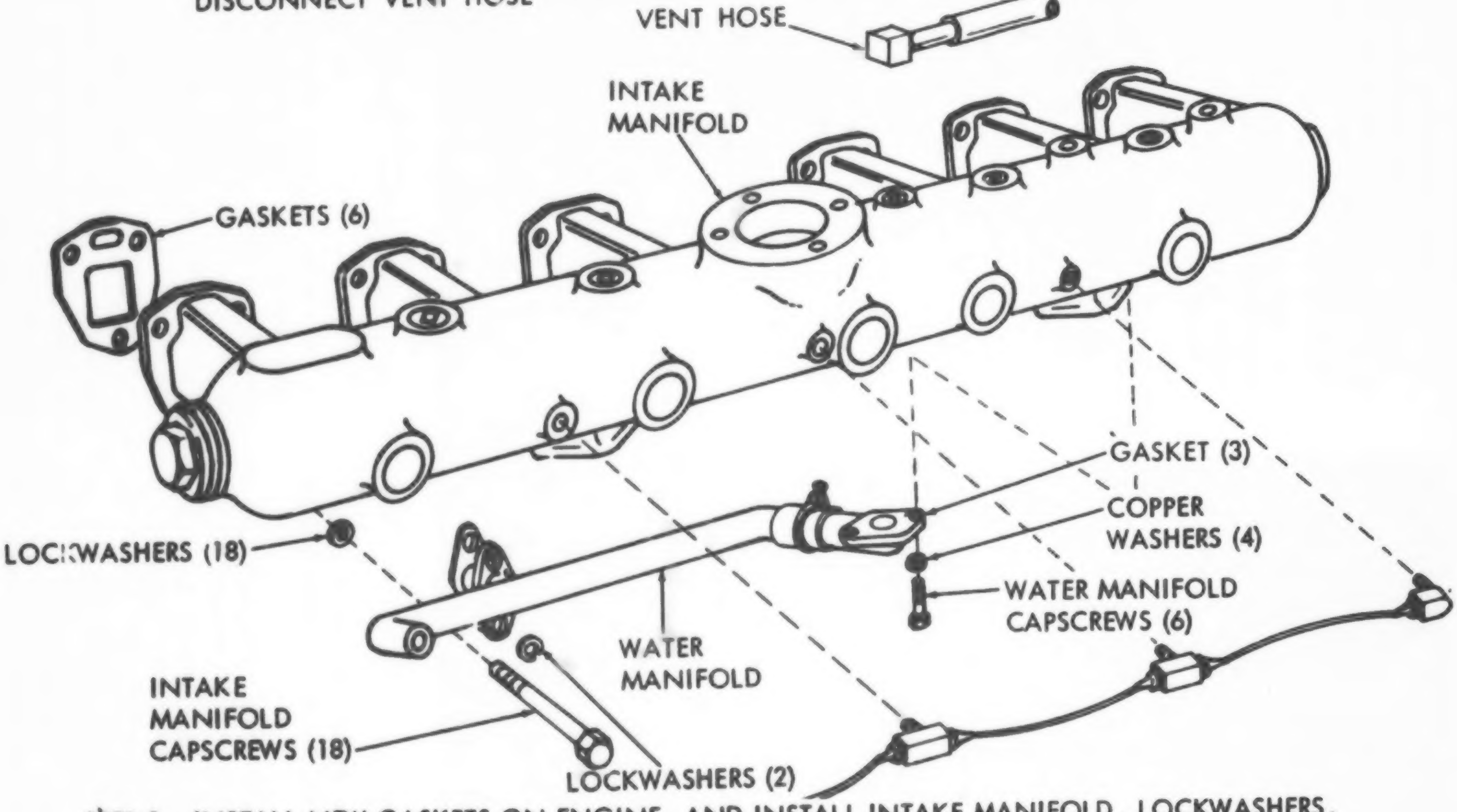
(1) Remove the spark plugs from the engine so that it can be turned to the required crankshaft positions.

(2) Refer to figure 7-53 and remove the valve tappet cover. Note that the eye bolts shown are for removing cylinder heads only. The eye bolt shown in figure 7-21, Part 2 is one of the eye bolts used in lifting the engine from the machine.

(3) Insert a suitable rachet extension into the socket in the front of the vibration damper and turn the engine over until the mark on the engine flywheel indicates that number one piston is on top dead center on the compression stroke. Refer to figure 3-29 for vibration damper location

STEP 1. REFER TO PARAGRAPH 7-40f AND REMOVE CARBURETOR AND LINKAGE, AND FIGURE 7-17 AND REMOVE STARTING AID FUEL LINE.

STEP 2. REMOVE WATER MANIFOLD CAPSCREWS AND WASHERS, AND INTAKE MANIFOLD CAPSCREWS AND LOCKWASHERS. REMOVE INTAKE MANIFOLD AND GASKETS. DISCONNECT VENT HOSE

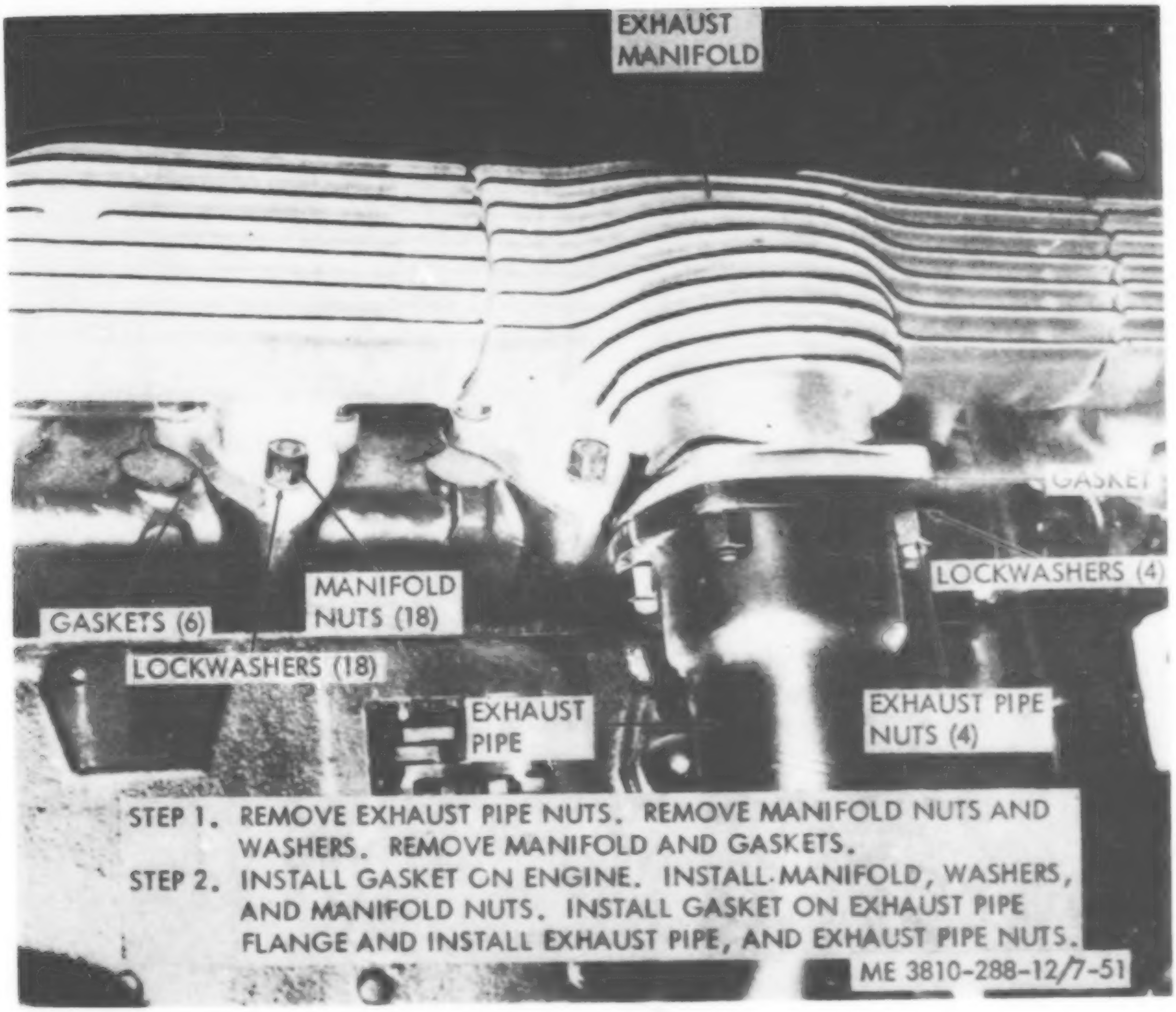

VENT HOSE
INTAKE MANIFOLD
GASKETS (6)
GASKET (3)
COPPER WASHERS (4)
LOCKWASHERS (18)
WATER MANIFOLD CAPSCREWS (6)
WATER MANIFOLD
INTAKE MANIFOLD CAPSCREWS (18)
LOCKWASHERS (2)

STEP 3. INSTALL NEW GASKETS ON ENGINE, AND INSTALL INTAKE MANIFOLD, LOCKWASHERS, AND INTAKE MANIFOLD CAPSCREWS. INSTALL NEW GASKETS ON WATER MANIFOLD AND INSTALL WATER MANIFOLD, LOCKWASHERS, COPPER WASHERS, AND WATER MANIFOLD CAPSCREWS.

STEP 4. REFER TO PARAGRAPH 7-40f AND INSTALL CARBURETOR AND LINKAGE, AND FIGURE 7-17 AND INSTALL STARTING AID FUEL LINE.

ME 3810-288-12/7-50

Figure 7-50. Intake manifold, removal and replacement.


EXHAUST MANIFOLD
GASKET
LOCKWASHERS (4)
MANIFOLD NUTS (18)
GASKETS (6)
LOCKWASHERS (18)
EXHAUST PIPE
EXHAUST PIPE NUTS (4)
ME 3810-288-12/7-51

STEP 1. REMOVE EXHAUST PIPE NUTS. REMOVE MANIFOLD NUTS AND WASHERS. REMOVE MANIFOLD AND GASKETS.

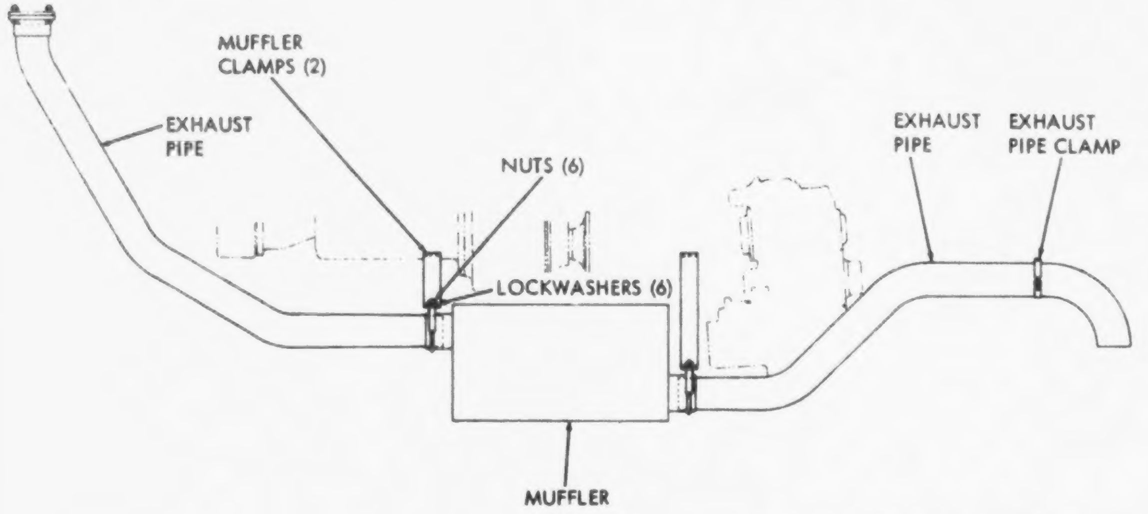
STEP 2. INSTALL GASKET ON ENGINE. INSTALL MANIFOLD, WASHERS, AND MANIFOLD NUTS. INSTALL GASKET ON EXHAUST PIPE FLANGE AND INSTALL EXHAUST PIPE, AND EXHAUST PIPE NUTS.

Figure 7-51. Exhaust manifold, removal and replacement.

STEP 1. REFER TO FIGURE 8-51 AND REMOVE EXHAUST PIPE NUTS AND LOCKWASHERS.

STEP 2. BLOCK MUFFLER AND EXHAUST PIPE IN POSITION. REMOVE NUTS AND LOCKWASHERS FROM MUFFLER AND EXHAUST PIPE CLAMPS. REMOVE MUFFLER AND EXHAUST PIPES, AND SEPARATE PIPES FROM MUFFLER.

STEP 4. ASSEMBLE EXHAUST PIPES AND MUFFLER. POSITION MUFFLER AND EXHAUST PIPES ON CARRIER. INSTALL MUFFLER AND EXHAUST PIPE CLAMPS AND SECURE WITH LOCKWASHERS AND NUTS.


MUFFLER CLAMPS (2)
EXHAUST PIPE
NUTS (6)
EXHAUST PIPE
EXHAUST PIPE CLAMP
LOCKWASHERS (6)
MUFFLER

ME 3810-288-12/7-52

Figure 7-52. Exhaust pipe and muffler, removal and replacement.

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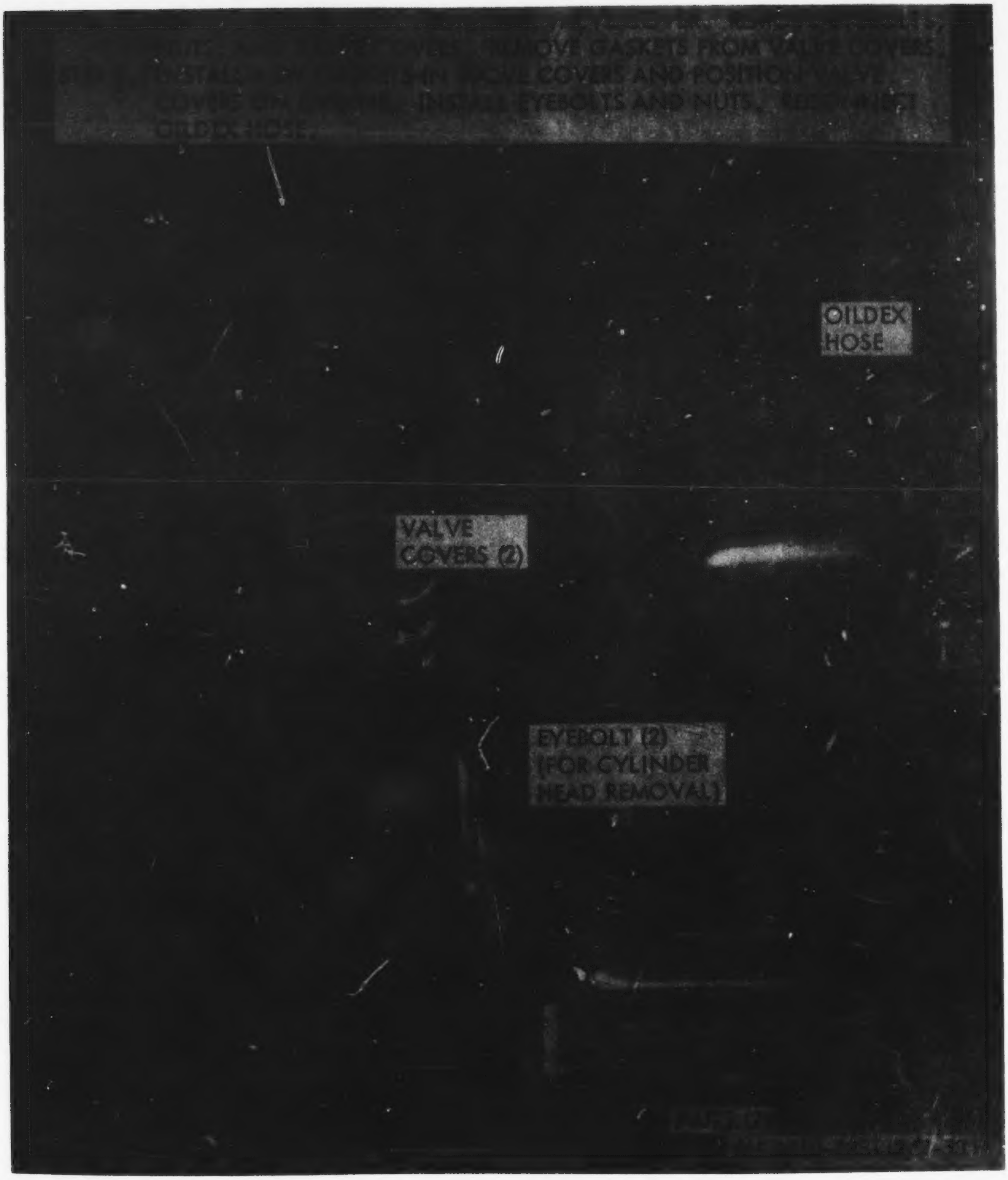


NUTS, AND VALVE COVERS. REMOVE GASKETS FROM VALVE COVERS.
STEP 2. INSTALL [illegible] IN VALVE COVERS AND POSITION VALVE
COVERS ON ENGINE. INSTALL EYEBOLTS AND NUTS. RECONNECT
OILDEX HOSE.

OILDEX HOSE
VALVE COVERS (2)
EYEBOLT (2) (FOR CYLINDER HEAD REMOVAL)

Figure 7-53. Valve tappet cover, removal and replacement.

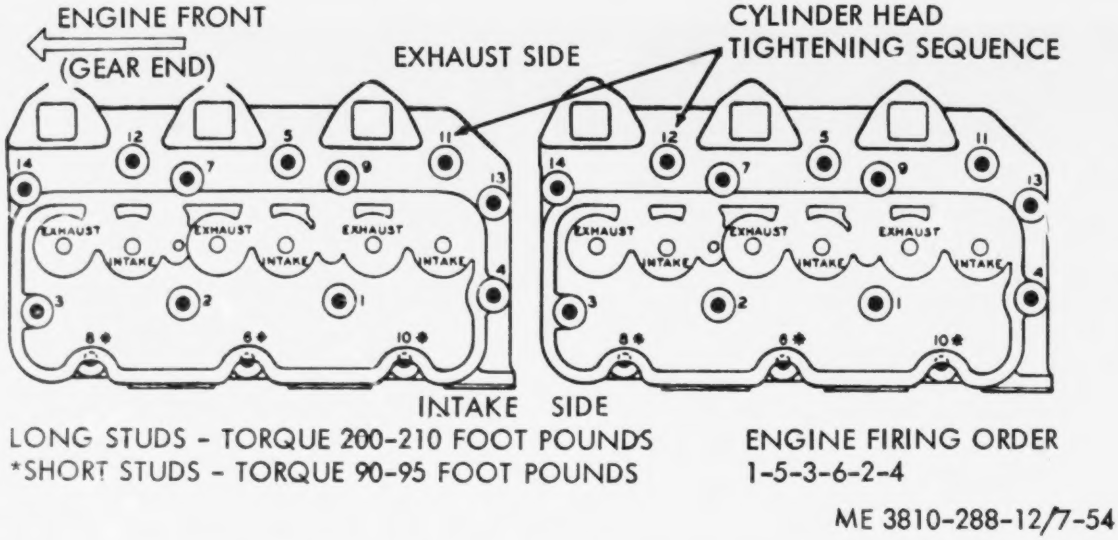

ENGINE FRONT
(GEAR END)
EXHAUST SIDE
CYLINDER HEAD
TIGHTENING SEQUENCE
EXHAUST
INTAKE
14
12
7
5
9
11
13
4
3
2
1
8*
6*
10*
INTAKE SIDE
LONG STUDS - TORQUE 200-210 FOOT POUNDS
*SHORT STUDS - TORQUE 90-95 FOOT POUNDS
ENGINE FIRING ORDER
1-5-3-6-2-4
ME 3810-288-12/7-54

Figure 7-54. Arrangement of exhaust and intake valves.

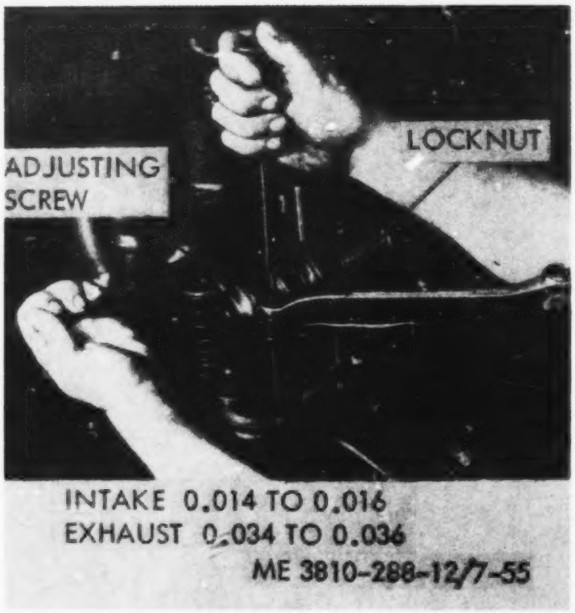

LOCKNUT
ADJUSTING SCREW
INTAKE 0.014 TO 0.016
EXHAUST 0.034 TO 0.036
ME 3810-288-12/7-55

Figure 7-55. Adjusting valve tappet clearance.

and figure 3-41 for appearance of the top dead center mark.

(4) The arrangement of the valves in this engine is as shown in figure 7-54. Refer to figure 7-55 and adjust the exhaust valve for cylinder number one to the clearance shown. Then adjust the intake valve to the clearance shown. Be sure to loosen the adjusting screw locknut before turning the adjusting screw, and to tighten the adjusting screw locknut before releasing the adjusting screw.

(5) Turn the engine over 120 crankshaft degrees (60 camshaft degrees) using the rachet. This will bring piston number five to top dead center on compression stroke. Repeat for each cylinder, in firing order sequence, which is 1-5-3-6-2-4.

(6) Refer to figure 7-53 and replace the valve tappet cover.

7-51. Clutch Control

a. Inspection. Inspect the clutch pedal free travel by depressing the clutch pedal by hand until resistance is felt, and then release the pedal. Measure the distance the pedal travels from the released position to where the resistance was felt. If the pedal free travel is less than ¾ inch or more than 1 inch the clutch must be adjusted.

b. Adjustment.

(1) With the clutch engaged, adjust the release sleeve to one (1) inch clearance between contact surface of release bearing housing and the machined surface of the clutch housing.

Note. Do not lock the sleeve locknut until the pedal linkage is adjusted for free travel.

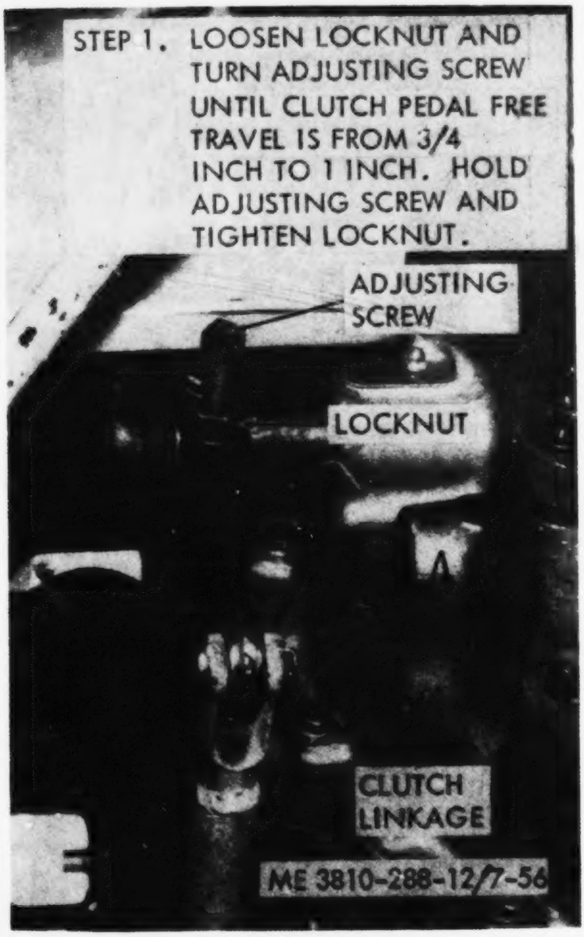
(2) Refer to figure 8-56 and adjust the clutch pedal free travel.

(3) Depress the clutch several times and recheck the clearance specified in step (1) above.

(4) Hold the clutch pedal down while the sleeve locknut is turned up to the release lever spider and securely tightened.

Note. Always disengage the clutch while the sleeve locknut is being locked or unlocked but have the clutch engaged while turning the threaded sleeve to obtain the proper distance which must be checked and maintained as wears occurs.

Note. The sleeve locknut (spanner nut) must be turned up against the release lever spider and securely locked. This can be accomplished by the use of a punch and hammer or spanner wrench.



STEP 1. LOOSEN LOCKNUT AND TURN ADJUSTING SCREW UNTIL CLUTCH PEDAL FREE TRAVEL IS FROM 3/4 INCH TO 1 INCH. HOLD ADJUSTING SCREW AND TIGHTEN LOCKNUT.

Figure 7-56. Clutch control, adjustment.

7-52. Gear Shift Controls

Refer to figure 7-57 and repair or replace components of the gear shift control as required.

7-53. Propeller Shafts

a. General. The locations of the four propeller shafts used on this machine are shown in figure 7-58. The propeller shafts which connect the driving axles to the transfer case are identical with the exception of their length.

b. Main Transmission Propeller Shaft Replacement. Refer to figure 7-58 and remove the capscrew, lockwashers, and nuts which connect the flanges at each end of the propeller shaft, and remove the propeller shaft. Install the propeller shaft as shown in figure 7-58.

c. Driving Axle Propeller Shaft Replacement. Refer to figure 7-58 and bend the lock straps away from the capscrews. Remove the capscrews, lock straps, and bearings from each end of the propeller shaft. Remove the propeller shaft. Install the propeller shaft as shown in figure 7-58.

7-54. Differential Service

Check the oil level in the front and rear differentials. The oil should be just up to the level plug opening. Add oil of the type listed in the lubrication order as required to bring the level to the oil level plug opening.

7-55. Outriggers

a. Replacement. Refer to figure 7-59 and remove and replace the outriggers.

b. Repair. Refer to figure 7-60 and remove any rust or corrosion from the outrigger beams and boxes, and paint in accordance with TM 9-213. Replace any damaged or bound outrigger beam roller or jack screws, and damaged outrigger box pins, eye pins or capscrews. Report any broken or cracked welds to the proper authority.

7-56. Seat

a. Removal. Refer to figure 7-61 and remove the capscrews, lockwashers, and nuts, and remove the seat.

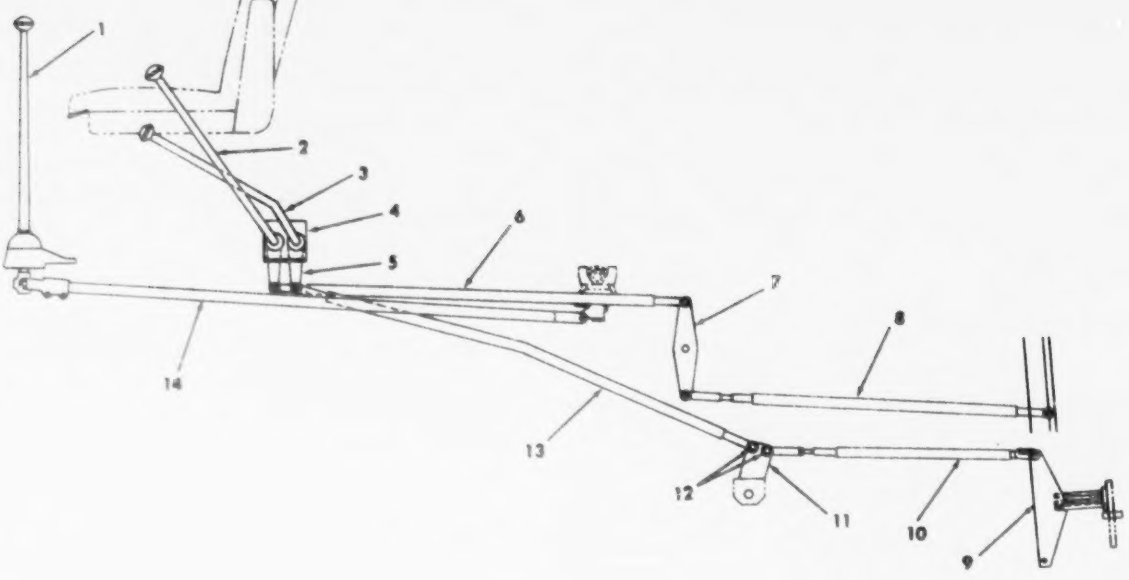
b. Installation. Refer to figure 7-61 and install the seat as shown.

7-57. Cab

Refer to figure 7-26 and remove and replace any damaged cab sheet metal.

7-58. Fender

Refer to figure 7-26 and remove or install the fenders.



ME 3810-288-12/7-57

1. Lever, main transmission control
2. Lever, transfer case control
3. Lever, front axle control
4. Bracket, control lever
5. Lever
6. Rod, transfer case control
7. Lever, idler
8. Rod, transfer case control, rear
9. Lever, front axle drive
10. Rod, front axle control, rear
11. Idler, shifter rod
12. Pin, yoke
13. Rod, front axle control, rear
14. Rod, main transmission control

Figure 7-57. Gear shift controls, repair and replacement.

7-59. Data Plates

The data plates are mounted on the machine with screws, lockwashers, and nuts. The lockwashers and nuts are placed behind the mounting panel.

7-60. Fire Extinguisher

Replace fire extinguishers which have been used, the seals of which have been broken, or which have lost weight of ¼ pound or more, with a like serviceable item.

7-61. Speedometer and Tachometer Drive

a. General. Customarily, only the flexible core of the speedometer or tachometer drive is replaced and a method of replacing it is described below. In the event that the entire cable must be replaced, a method of replacing it is also described.

b. Flexible core replacement. Loosen the knurled nuts at each end of the flexible drive cable and remove the end. Withdraw the flexible core from within the sheath. Install a new flexible core in the sheath from the gage end, and attach the ends of the flexible drive with the knurled nuts.

c. Drive cable installation. Install the new drive cable in the same clamps as the old cable, and attach the ends of the cable with the knurled nuts.

7-62. Boom Rest

a. Removal. Refer to figure 7-62 and remove the boom rest.

b. Replacement. Replace the boom rest on the machine as shown in figure 7-62.

7-63. Tool Box

a. Removal. Refer to figure 7-63 and remove the tool box.

b. Replacement. Replace the tool box as shown in figure 7-63.

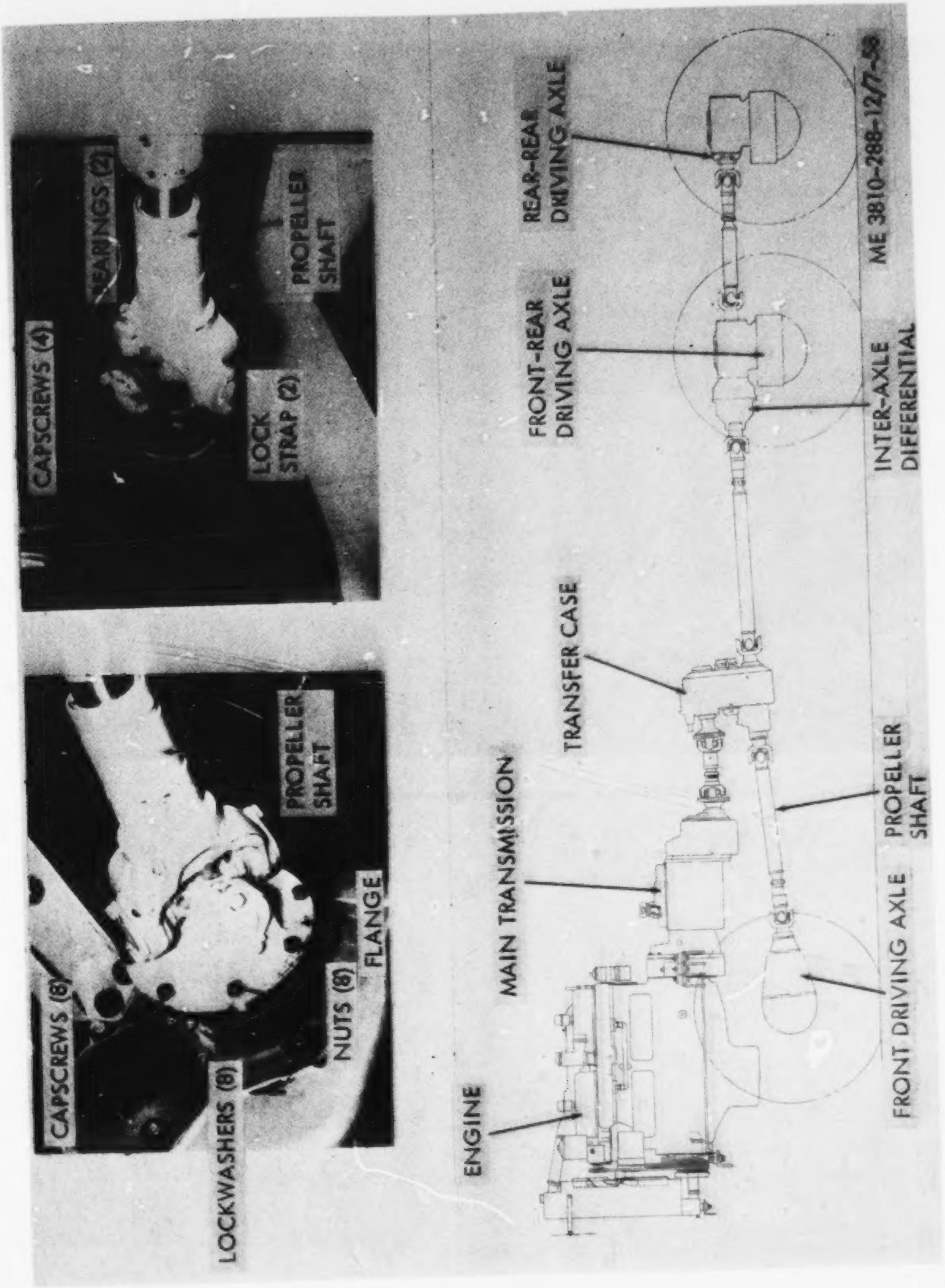
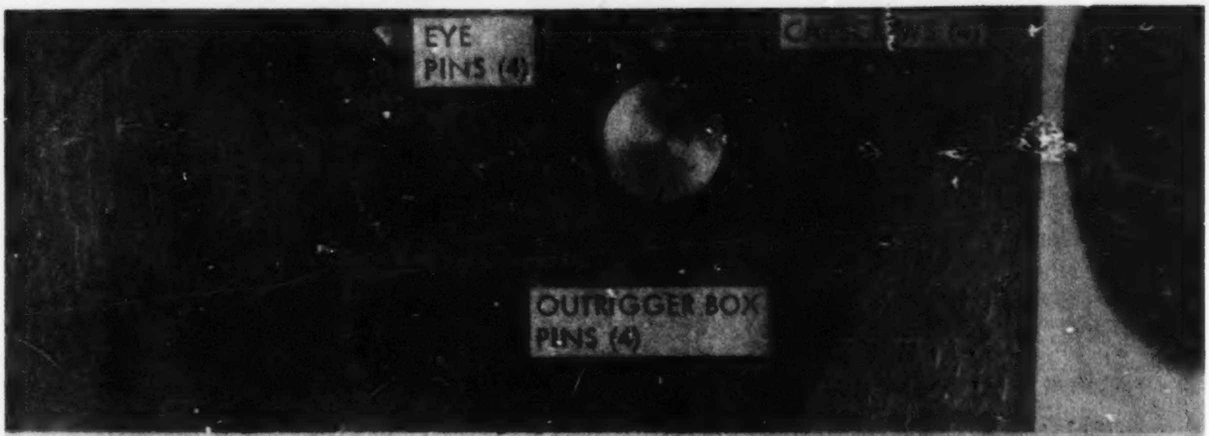

LOCKWASHERS (8)
CAPSCREWS (8)
NUTS (8)
FLANGE
PROPELLER SHAFT
CAPSCREWS (4)
BEARINGS (2)
LOCK STRAP (2)
PROPELLER SHAFT
ENGINE
MAIN TRANSMISSION
TRANSFER CASE
FRONT-REAR DRIVING AXLE
REAR-REAR DRIVING AXLE
FRONT DRIVING AXLE
PROPELLER SHAFT
INTER-AXLE DIFFERENTIAL
ME 3810-288-12/7-58

Figure 7-58. Propeller shaft, removal and replacement.



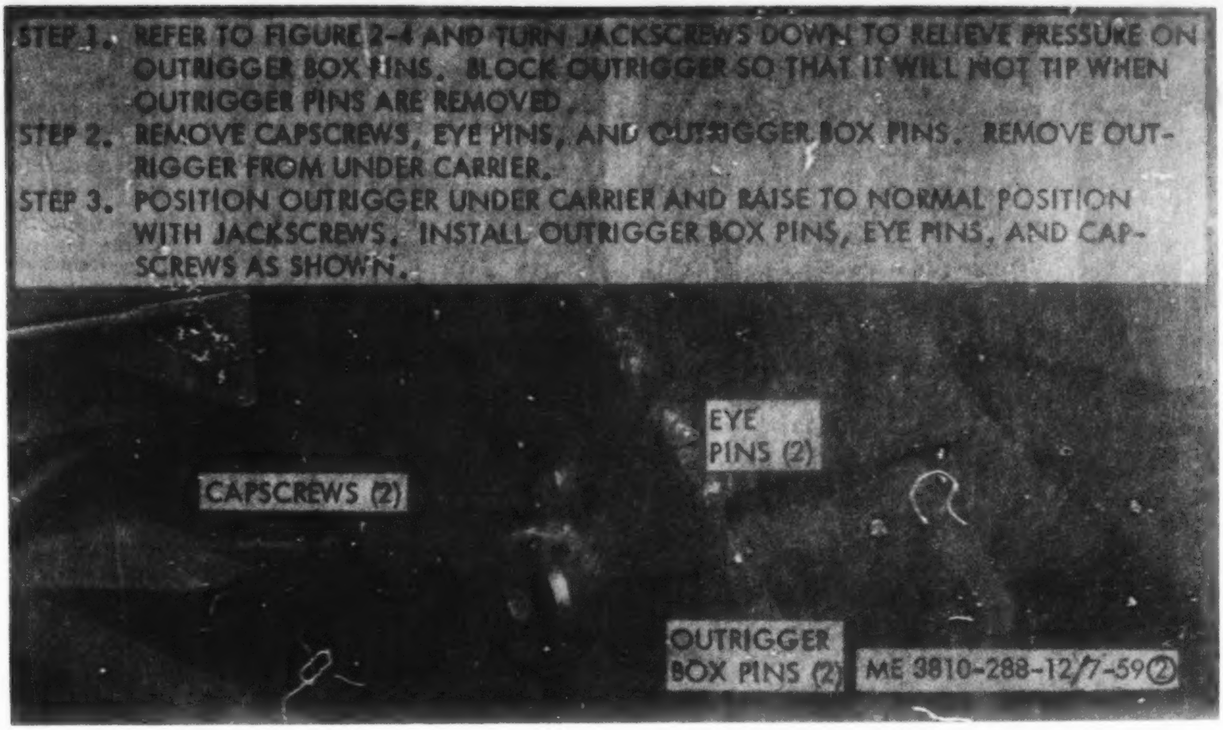
STEP 1. DISCONNECT TRAILER ELECTRICAL COUPLING, SERVICE AIR COUPLING, AND EMERGENCY AIR COUPLING. REFER TO FIGURE 2-4 AND TURN JACKSCREWS DOWN TO RELIEVE PRESSURE ON OUTRIGGER BOX PINS.
BLOCK OUTRIGGER SO THAT IT WILL NOT TIP WHEN OUTRIGGER PINS ARE REMOVED.

STEP 2. REMOVE CAPSCREWS, EYE PINS, AND OUTRIGGER BOX PINS. REMOVE OUTRIGGER FROM CARRIER.

STEP 3. POSITION OUTRIGGER NEXT TO CARRIER AND RAISE TO NORMAL POSITION WITH JACKSCREWS. INSTALL OUTRIGGER BOX PINS, EYE PINS, AND CAPSCREWS AS SHOWN.

ME 3810-288-12/7-59①

Figure 7-59. Outrigger, removal and replacement. (Sheet 1 of 2)



STEP 1. REFER TO FIGURE 2-4 AND TURN JACKSCREWS DOWN TO RELIEVE PRESSURE ON OUTRIGGER BOX PINS. BLOCK OUTRIGGER SO THAT IT WILL NOT TIP WHEN OUTRIGGER PINS ARE REMOVED.

STEP 2. REMOVE CAPSCREWS, EYE PINS, AND OUTRIGGER BOX PINS. REMOVE OUTRIGGER FROM UNDER CARRIER.

STEP 3. POSITION OUTRIGGER UNDER CARRIER AND RAISE TO NORMAL POSITION WITH JACKSCREWS. INSTALL OUTRIGGER BOX PINS, EYE PINS, AND CAPSCREWS AS SHOWN.

EYE PINS (2)
CAPSCREWS (2)
OUTRIGGER BOX PINS (2)
ME 3810-288-12/7-59②

Figure 7-59. Outrigger, removal and replacement. (Sheet 2 of 2)

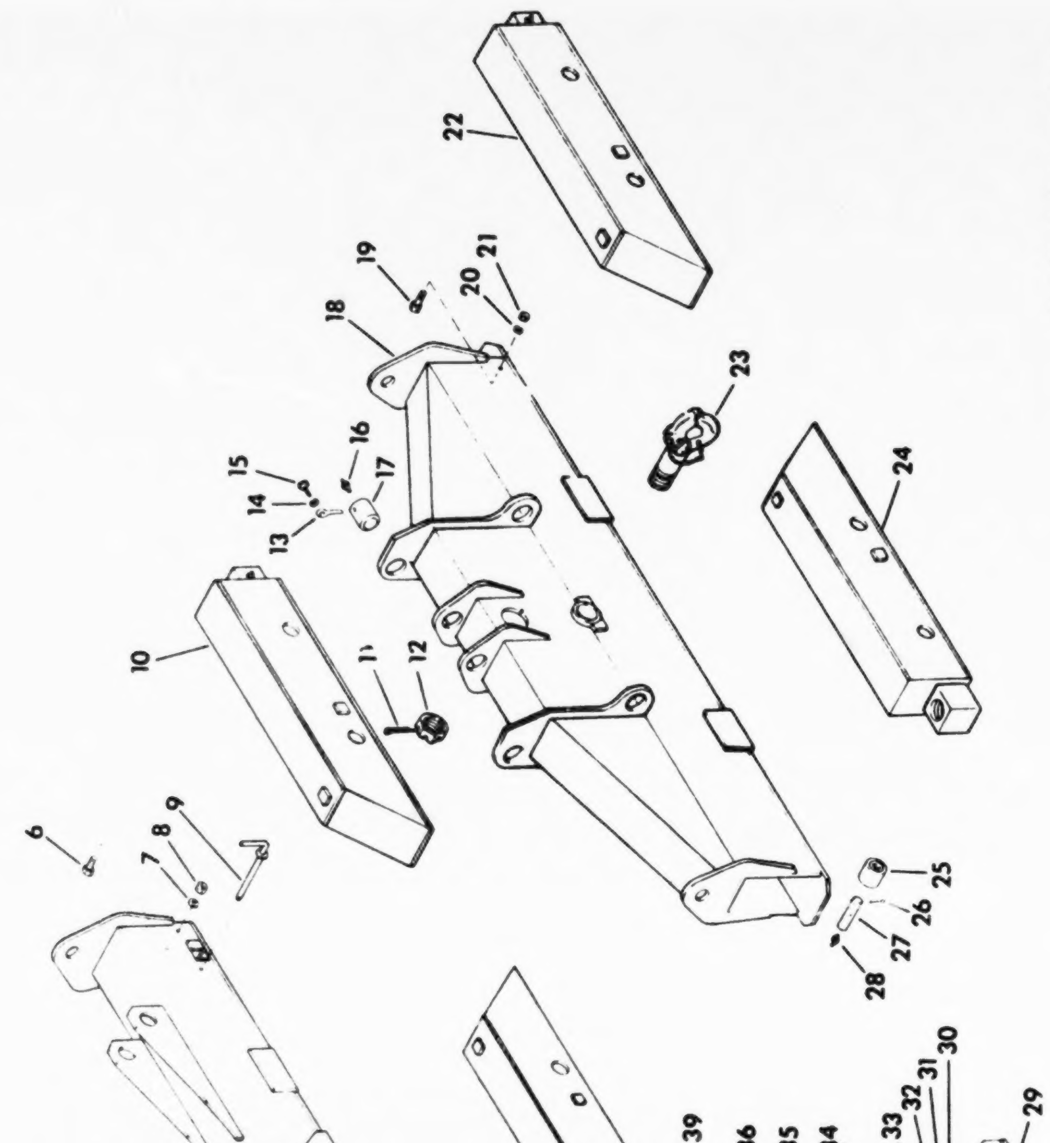

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Figure 7-60. Outrigger assembly, repair.

1. Capscrew
2. Lock washer
3. Rod end
4. Pin, outrigger box
5. Outrigger box, front
6. Capscrew
7. Lock washer
8. Nut, jam
9. Pin, beam lock
10. Outrigger beam
11. Pin, cotter
12. Nut
13. Rod end
14. Lock washer
15. Capscrew
16. Fitting, grease
17. Pin, outrigger box
18. Outrigger box, rear
19. Capscrew
20. Lock washer
21. Nut, jam
22. Outrigger beam
23. Pintle hook
24. Outrigger beam
25. Roller, beam
26. Pin, cotter
27. Pin, roller
28. Fitting, grease
29. Outrigger float
30. Pin
31. Pin, cotter
32. Capscrew
33. Washer, flat
34. Chain
35. Outrigger, jackscrew
36. Capscrew
37. Lock washer
38. Nut
39. Fitting, grease
40. Outrigger beam
41. Cover, jackscrew
42. Roller, beam
43. Pin, roller
44. Fitting, grease
45. Pin, cotter

Figure 7-60. Outrigger assembly, repair.

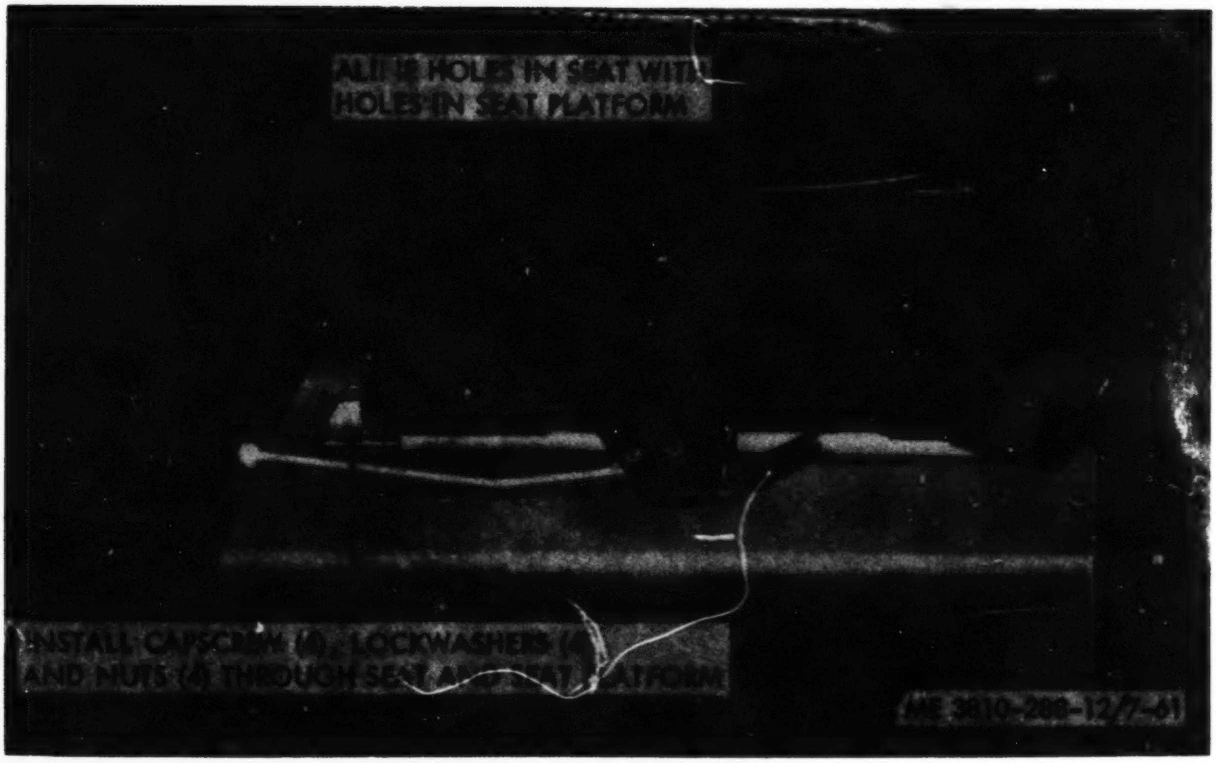

ALIGN HOLES IN SEAT WITH
HOLES IN SEAT PLATFORM
INSTALL CAPSCREW (4), LOCKWASHERS (4)
AND NUTS (4) THROUGH SEAT AND SEAT PLATFORM
ME 3810-288-12/7-61

Figure 7-61. Seat installation.

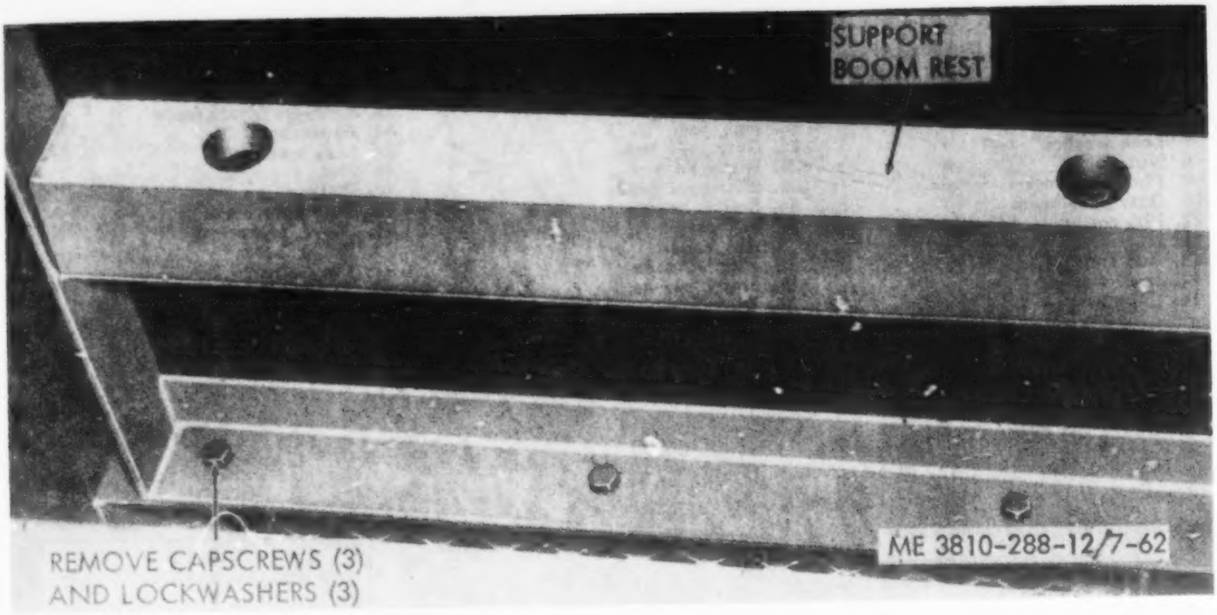
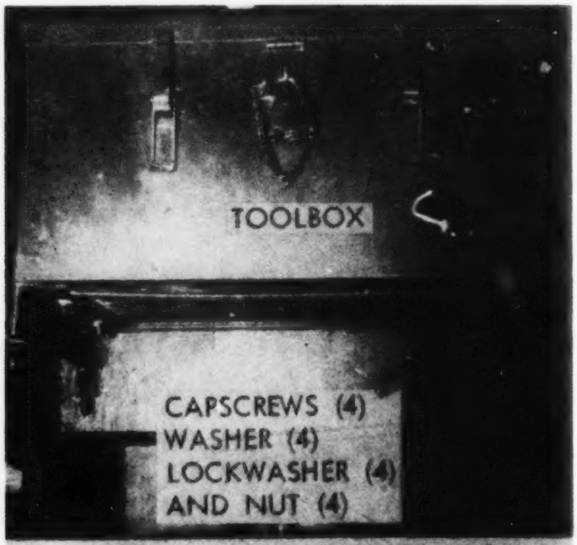

SUPPORT BOOM REST
REMOVE CAPSCREWS (3) AND LOCKWASHERS (3)
ME 3810-288-12/7-62

Figure 7-62. Boom rest installation.


TOOLBOX
CAPSCREWS (4)
WASHER (4)
LOCKWASHER (4)
AND NUT (4)

STEP 1. REMOVE NUTS AND LOCKWASHERS.
STEP 2. REMOVE TOOL BOX.

ME 3810-288-12/7-63

Figure 7-63. Tool box installation.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10	Hand portable fire extinguishers for Army users

A-2. Lubrication

LO 5-3810-288-12	Lubrication Order
C 91001L	Fuels, Lubricants, Oil and Waxes.

A-3. Paint

TM 9-213	Painting instructions for Field use.

A-4. Radio Suppression

TM 11-483	Radio interference suppression

A-5. Maintenance

TM 9-1870-1	Care and maintenance of pneumatic tires.
TB ORD 651	Use of antifreeze solutions and cleaning compounds in engine cooling system.
TM 38-750	Army Equipment Record Procedures.
TM 5-3810-288-20P	Organizational Maintenance Repair Parts & Special Tools Lists
TM 9-6140-200-15	Operation and Organizational Field & Depot Maintenance, Storage Batteries, Lead Acid Type.
TB 385-101	Safety use of Cranes, Crane-Shovel.

A-6. Shipment and Storage

TB 740-93-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage.
TM 740-90-1	Administrative Storage of USAMEC Mechanical Equipment

APPENDIX B

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

B–1. Scope

This appendix lists items which accompany the Model M320T Truck Crane or are required for installation, operation, or operator's maintenance. Repair parts and special tools assigned maintenance code "C" in the –20P, Organizational Maintenance Repair Parts and Special Tools List, may be stocked at the operator level of maintenance when authorized by the Unit Commander.

B–2. General

This Basic Issue Items List is divided into the following sections:

a. Basic Issue Items—Section II. A list of items which accompany the Model M320T Truck Crane and are required by the operator/crew for installation, operation, or maintenance

b. Maintenance and Operating Supplies—Section III. A listing of maintenance and operating supplies required for initial operation.

B–3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

a. Source, Maintenance, and Recoverability Codes (SMR):

(1) Source code, indicates the selection status and source for the listed item. Source codes are:

Code	*Explanation*
P	Repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
M	Repair parts which are not procured or stocked, but are to be manufactured in indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement of such items will be filled by use of the next higher assembly or component.
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain them through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
C	Repair parts authorized for local procurement. Where such repair parts are not obtainable from local procurement, requirements will be requisitioned through normal supply channels accompanied by a supporting statement of non-availability from local procurement.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above GS and DS level or returned to depot supply levels.

(2) Maintenance code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	*Explanation*
C	Operator/crew

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	*Explanation*
R	Repair parts and assemblies which are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable they will be evacuated to a depot for evaluation and analysis before final disposition.

Code	Explanation
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e", when used as a part of the nomenclature, indicates the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parenthesis. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.

d. Unit of Measure (U/M). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers, etc.).

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) Figure number indicates the figure number of the illustration in which the item is shown.

(2) Item number indicates the callout number used to reference the item in the illustration.

B-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies—Section III

a. Component Application. This column identified the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for Eight Hours Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

Section II. BASIC ISSUE ITEMS

(1) SMR Code	(2) Federal stock number	(3) Description Ref No. & mfr Code	Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with Equip.	(7) Illustration (a) Fig. No.	(b) Item No.
PC	7520-559-9618	Case: Operations & Maintenance Manual		ea.	1	1		
		Dept of Army Tech Manual TM5-3810-288-12		ea.	1	1		
		Dept of Army Lub Order		ea.	1	1		
		LO5-3810-288-12-1		ea.	1	1		
		LO5-3810-288-12-2		ea.	1	1		
		LO5-3810-288-12-3		ea.	1	1		
		LO5-3810-288-12-4		ea.	1	1		
PC	4210-889-2221	Extinguisher, Fire		ea.	2	2		
PC	7510-889-3494	Binder, Loose Leaf		ea.	1	1		
PC	2590-505-6736	Case Rifle		ea.	2	2		

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F/initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
Air cleaner		OIL LUBRICATING			(1) Includes quantity of oil to fill engine oil system as follows: *Crane Engine:* 16 qts. *Carrier Engine:* 28 qts. *Carrier Air Cleaner:* 4 qts. *Crane Air Cleaner:* 2 qts.
	9150-265-9435(2)	OE 30	(1)	(3)	
	9150-265-9428(2)	OE 10	(1)	(3)	
	9150-242-7603(2)	OES	(1)	(3)	
Crankcase		OIL, LUBRICATING: 5 gal. can as follows:			
	9150-265-9435(2)	OE 30	(1)	(3)	(2) See C91001L for additional data and requesting procedure.
	9150-265-9428(2)	OE 10	(1)	(3)	
	9150-242-7603(2)	OES	(1)	(3)	
Differentials		LUBRICATING OIL, GEAR: 5 gal. drum as follows:			(3) See current I.O. for grade application and replenishment intervals.
	9150-577-5847(2)	GO 140	(7)	(3)	
	9150-577-5844(2)	GO 90	(7)	(3)	
Exposed gear		LUBRICATING OIL, EXPOSED GEAR: 35 lb. pail as follows:			(4) Fuel Tank capacities: *Crane:* 50 gals. *Carrier:* 75 gals.
	9150-261-5197(2)	CW11-A	5 lbs.	(3)	
	9150-246-3276(2)	CW11-B	5 lbs.	(3)	
	9150-243-2918(2)	CW11-C	5 lbs.	(3)	
Gear and chaincase		LUBRICATING OIL, GEAR: 5 gal. can as follows:			(5) Average fuel consumption gal. per hour (GPH) of continuous operation: *Crane:* 7.5 GPH *Carrier:* 13.7 GPH
	9150-577-5847(2)	GO 140	729-S	(3)	
	9150-577-5844(2)	GO 90	729-S	(3)	
Greasepoints		GREASE, AUTOMATIVE AND ARTILLIARY: 35 lbs. pail as follows:			(6) Transmission capacities: *Crane:* 3½ qts. *Carrier:* 8 qts. *Engine:* 4 qts.
	9150-190-0907(2)	GAA			
Hydraulic Control reservoir		BRAKE FLUID: automative 1 gal. can as follows:			(7) Front Axle 11 qts. Rear Axle 11 qts.
	9150-152-6375(2)	HBA	3 qts.	(3)	
Hydraulic steering system		HYDRAULIC FLUID: 1 gal. can as follows:			
	9150-223-4134(2)		7 qts.	(3)	

Section III. MAINTENANCE AND OPERATING SUPPLIES—Cont'd

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F/initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
Power transfer		LUBRICATING OIL, GEAR: 5 gal. drum as follows:			
	9150-577-5842(2)	GO 140	6⅛ qts.	(3)	
	9150-577-5844(2)	GO 90	6⅛ qts.	(3)	
Radiator		WATER: crane engine	38 qts.		
		WATER: carrier engine	60 qts.		
		ANTIFREEZE: 55 gal. drum as follows:			
	6850-243-1990	Ethylene Glycol			
		Crane Engine	24 qts.		
		Carrier Engine	36 qts.		
	6850-174-1806	ANTIFREEZE: compound arctic			
		Crane Engine	38 qts.		
		Carrier Engine	60 qts.		
Tank, fuel	9130-160-1818(2)	FUEL, GASOLINE: bulk as follows:			
		Automative combat 91A	(4)	(5)	
Transmission		LUBRICATING OIL GEAR: 5 gal. drum as follows:			
	9150-577-5847(2)	GO 140	(6)	(3)	
	9150-577-5844(2)	GO 90	(6)	(3)	
	9150-257-5440(2)	GOS	(6)	(3)	

APPENDIX C

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

C-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III not applicable.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

C-2. Explanation of Columns in Section II

a. Group Number, Column (1). The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1, Functional Grouping Codes) are listed on the MAC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. Functional Group, Column (2). This column contains a brief description of the components of each functional group.

c. Maintenance Functions, Column (3). This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

C—Operator or crew
O—Organizational maintenance
F—Direct support maintenance
H—General support maintenance
D—Depot maintenance

The maintenance functions are defined as follows:

A—Inspect: To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B—Test: To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C—Service: To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.

D—Adjust: To rectify to the extent necessary to bring into proper operating range.

E—Aline: To adjust specified variable elements of an item to bring to optimum performance.

F—Calibrate: To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G—Install: To act up for use in an operational environment such as an emplacement, site, or vehicle.

H—Replace: To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I—Repair: To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J—Overhaul: To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

K—Rebuild: To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item

d. Tools and Equipment, Column (4). This column is provided for referencing by code the special tools and test equipment, (sec III) required to perform the maintenance functions (sec II).

e. Remarks, Column (5). This column is provided for referencing by code the remarks (sec. IV) pertinent to the maintenance functions.

C-3. Explanation of Columns in Section IV

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to Section II. The first letter references column 5 and the second letter references a maintenance function, Column 3, A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functional group	(3) Maintenance functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
	PART I CRANE (135GKC)													
01	**ENGINE**													
0100	**Engine Assembly:**													
	Engine	--	O	O	--	--	--	--	F	O	H	--	--	A–B
0101	**Crankcase, Cyl. Head:**													
	Crankcase	O	--	O	--	--	--	--	H	H				
	Head cylinder	--	--	--	--	--	--	--	F	H				
0102	**Crankshaft:**													
	Crankshaft assy.	H	--	--	--	--	--	--	H	D	--	--	--	B–I
0103	**Flywheel Assembly:**													
	Flywheel	F	--	--	--	--	--	--	F	F	--	--	--	C–I
0104	**Pistons & Connecting Rods:**													
	Pistons	H	--	--	--	--	--	--	H					
	Rods, connecting	H	--	--	--	H	--	--	H	H				
0105	**Valves Camshaft & Timing Systems:**													
	Valves and inserts	--	--	--	--	--	--	--	F	F				
	Arms, rocker	--	--	--	O	--	--	--	F	F				
	Tappets	F	--	--	--	--	--	--	F					
	Camshaft, bearings & Gear timing	H	--	--	--	--	--	--	H					
	Cover	O	--	--	--	--	--	--	H					
0106	**Engine Lubrication System:**													
	Pump, oil	F	--	--	--	--	--	--	F	F				
	Pan, oil	O	--	--	--	--	--	--	F					
	Filter, oil	--	--	O	--	--	--	--	O					
	Lines, external	--	--	O	--	--	--	--	O	O				
0108	**Manifolds:**													
	Manifold assembly	O	--	--	--	--	--	--	O	O				
0109	**Accessory Drive Mechanism:**													
	Shaft	--	--	--	--	--	--	--	O	F				
	Housing	--	--	--	--	--	--	--	O	F				
02	**CLUTCH**													
0200	**Clutch Assembly:**													
	Clutch assembly	O	--	--	O	--	--	--	F	F				

Section II. MAINTENANCE ALLOCATION CHART—Cont'd

(1)	(2)	(3) Maintenance functions											(4)	(5)
		A	B	C	D	E	F	G	H	I	J	K		
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks
03	FUEL SYSTEM:													
0301	Carburetor:													
	Carburetor	--	--	--	O	--	--	--	O	F	--	--	--	D-H
0302	Fuel Pump:													
	Pump, fuel	--	F	--	--	--	--	--	O					
0304	Air Cleaner:													
	Cleaner, air assy.	--	--	C	--	--	--	--	O					
0306	Tanks Lines, Fitting													
	Fittings, lines	--	--	--	--	--	--	--	O	O				
	Tank assy.	--	--	C	--	--	--	--	O	H				
0308	Engine Speed Governor:													
	Governor assy.	--	--	--	O	--	--	--	O	F				
	Controls	--	--	--	O	--	--	--	O					
0309	Fuel Filters:													
	Filter, fuel	--	--	C	--	--	--	--	O					
0311	Engine Starting Aids:													
	Pump and fittings	C	--	--	--	--	--	--	O					
	Lines	--	--	--	--	--	--	--	O	O				
0312	Throttle or Choke Control:													
	Control throttle	--	--	C	--	--	--	--	O	O				
	Control choke	--	--	C	--	--	--	--	O					
04	EXHAUST SYSTEM:													
0401	Muffler and Pipes:	C	--	--	--	--	--	--	O					
05	COOLING SYSTEM:													
0501	Radiator:													
	Radiator	--	--	C	--	--	--	--	O	H				
	Cap radiator	--	O	--	--	--	--	--	O					
0502	Cowling:													
	Cowling	--	--	--	--	--	--	--	O	F				
0503	Water Manifold & Thermostat:													
	Thermostat & housing	--	--	O	--	--	--	--	O					
	Gasket lines	--	--	--	--	--	--	--	O	O				
0504	Water Pump:													
	Pump, water	--	--	--	--	--	--	--	O	F				

0505	Fan Assembly													
	Bearing, shaft, pulley	--	--	O	--	--	--	--	O					
	Belt	--	--	--	O	--	--	--	O					
	Guard	--	--	--	--	--	--	--	O	F				
06	ELECTRICAL SYSTEM:													
0601	Generator:													
	Generator assy.	--	O	--	--	--	--	--	O	F			--	E–H
	Belt	--	--	--	O	--	--	--	O					
0603	Starting Motor:													
	Starter assembly	--	O	--	--	--	--	--	O	F			--	F–H
	Solenoid assembly	--	O	--	--	--	--	--	O					
	Brushes	F	--	--	--	--	--	--	F					
0605	Ignition Components:													
	Distributor assembly	--	--	C	--	--	--	--	O	F			--	G–H
	Coil	--	O	--	--	--	--	--	O					
	Spark plugs	--	O	--	O	--	--	--	O					
	Wires, suppression	--	O	--	--	--	--	--	O	F				
0607	Engine Control Panel:													
	Box and panel	C	--	--	--	--	--	--	F					
	Gauges	C	--	--	--	--	--	--	O					
	Switches, wiring	--	--	--	--	--	--	--	F	O				
0608	Miscellaneous Items:													
	Receptacle							--	O					
	Cables, slave							--	O	O				
0609	Lights:													
	Lights	C	--	--	--	--	--	--	O	O				
0610	Sending Units:													
	Sending unit	--	--	--	--	--	--	--	O					
	Engine warning lights & switch	--	O	--	--	--	--	--	O					
0611	Horn:													
	Horn, button, wiring	C	--	--	--	--	--	--	O					
0612	Batteries:													
	Battery	--	O	C	--	--	--	--	O					
	Cables	C	--	C	--	--	--	--	O					
	Box	--	--	--	--	--	--	--	O	F				
0613	Hull Wiring, Harness:													
	Conduit	C	--	--	--	--	--	--	O					
	Wiring	--	--	--	--	--	--	--	F	O				
0615	Radio Interference Supression:													
	Components	--	O	--	--	--	--	--	O					
07	TRANSMISSION													
0700	Transmission Assy	C	--	C	--	--	--	--	F	F	H			

Section II. MAINTENANCE ALLOCATION CHART—Cont'd

(1)	(2)	(3) Maintenance functions											(4)	(5)
		A	B	C	D	E	F	G	H	I	J	K		
Group No	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks
0701	Transmission Shaft:													
	Gear, bearing, seals	H	--	--	--	--	--	--	H					
09	PROPELLER SHAFTS													
0900	Shaft Assembly	--	--	--	--	--	--	--	O	F				
18	CAB													
1801	Cab Assembly:													
	Cab	--	--	--	--	--	--	--	F	H				
	Doors	--	--	--	--	--	--	--	O	H				
	Glass	C	--	--	--	--	--	--	O					
1806	Seats:													
	Seat	--	--	--	--	--	--	--	O	F				
1808	Boxes:													
	Box tool	--	--	--	--	--	--	--	O	F				
22	ACCESSORY ITEMS													
2202	Accessory Items:													
	Heater	--	--	--	--	--	--	--	O	O				
43	HYDRALUIC SYSTEMS:													
4300	Hydraulic System	C	C											
4301	Hose, Pipe Fittings:													
	Hose, fitting, tubing	--	--	--	--	--	--	--	O	O				
4305	Manifold and/or Control Valves:													
	Cylinder master	--	--	--	--	--	--	--	O	F				
4307	Hydraulic Cylinders:													
	Cylinder, hydraulic	--	--	--	--	--	--	--	O	F				
4308	Liquid Tank or Reservoir	--	--	O	--	--	--	--	O					
47	GAGES													
4701	Instruments:													
	Tachometer assy.	C	--	--	--	--	--	--	O					
74	CRANES, SHOVELS & EARTH WORKING EQUIPMENT:													

7402	Hoist:												
	Boom hoist pawl and brake assembly	--	--	--	O	--	--	--	H				
7403	Swing Brake Assembly:												
	Shaft, bearing	H	--	--	--	--	--	--	H				
7410	Shovel Front Attachments:												
	Shovel front attachment	--	--	C	C	--	--	--	C	O	H		
	Boom shovel	--	--	--	--	--	--	--	F	O			
	Sprockets	--	--	--	--	--	--	--	O	F			
	Chain	--	--	--	C	--	--	--	O	O			
	Tightener	--	--	--	--	--	--	--	O	O			
	Dipper; pulley assembly;												
	Stick assembly	--	--	--	--	--	--	--	F	F			
	Braces, pitch, mechanism												
	Dipper	--	--	C	--	--	--	--	O				
	Teeth dipper	C	--	--	--	--	--	--	C				
	Rack	C	--	--	--	--	--	--	F				
	Magnetic switch, solenoid & push button	C	--	--	--	--	--	--	O				
	Wire assembly	--	--	--	--	--	--	--	O	O			
7411	Crane, Dragline or Clamshell Attachments:												
	Boom, crane	--	--	C	--	--	--	--	O	F			
	Pulley, roller guide	--	--	C	--	--	--	--	O				
	Block, hook	--	--	C	--	--	--	--	C	F			
	Tagline	--	--	C	C	--	--	--	C	O			
	Bridle assembly	--	--	--	--	--	--	--	O	O			
	Bucket, Clamshell & dragline	--	--	C	--	--	--	--	C	C			
	Teeth, bucket	C	--	--	--	--	--	--	C				
	Fairlead, boom harness	--	--	C	--	--	--	--	C				
	Rollers	--	--	--	--	--	--	--	O	F			
	Boom, jib mast	--	--	C	--	--	--	--	C	O			
	Cables	--	--	--	C	--	--	--	C				
	Pulleys	--	--	--	--	--	--	--	O	F			
	Sockets & pins	C	--	--	--	--	--	--	C				
7412	Backhoe Attachments:												
	Backhoe	--	--	C	--	--	--	--	O	O	H		
	Boom assy. backhoe	--	--	--	--	--	--	--	O	F			
	Derrick assy.	--	--	--	--	--	--	--	F	F			
	Brace, dipper	C	--	--	--	--	--	--	O				
	Teeth	C	--	--	--	--	--	--	C				
	Dipper assy.	--	--	--	C	--	--	--	O	O			

Section II. MAINTENANCE ALLOCATION CHART—Cont'd

(1)	(2)	(3) Maintenance functions											(4)	(5)
		A	B	C	D	E	F	G	H	I	J	K		
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks
	Bracket assy., block and link assy., pulley	--	--	--	--	--	--	--	O	F				
7413	Pile Drive Attachment:													
	Pile drive rig	--	--	C	--	--	--	--	C	O				
7414	Base Deck:													
	Frame assy., revolving	--	--	--	--	--	--	H	H					
7415	Clutch:													
	Clutch assys.	--	--	C	C	--	--	--	H	H				
	Shoes clutch	--	--	--	--	--	--	--	O	F				
	Guard	C	--	--	--	--	--	--	O					
7416	Shafts:													
	Shaft assys.	--	--	--	--	--	--	--	H	H				
	Bands brake	--	--	--	C	--	--	--	O	F				
	Guards, gear spur	--	--	--	--	--	--	--	O	O				
7419	Turntable:													
	Lock assy. swing	--	--	--	O	--	--	--	O	F				
	Rollers rear	--	--	--	O	--	--	--	O	F				
	Roller assy. front	--	--	--	O	--	--	--	O	F				
7420	Machinery frame:													
	Frame machinery	--	--	--	--	--	--	--	H	H				
	Case gear guard machinery	--	--	--	--	--	--	--	O	O				
7421	Independent Boom Hoist:													
	Shaft assembly	--	--	--	--	--	--	--	H	H				
	Band brake	--	--	--	C	--	--	--	O	F				
	Chain	--	--	--	--	--	--	--	O					
	Clutch jaw	--	--	--	--	--	--	--	O					
7422	Machine Mechanism Controls:													
	Rods, levers, pedals, Shafts, linkage,	--	--	C	C	--	--	--	O	O				
	Bearings, sleeve	O	--	--	--	--	--	--	O					
7423	Gantry:													
	Frame gantry	O	--	--	--	--	--	--	F	F				

7499	Cables:													
	Cables	C	--	C	--	--	--	--	C					
76	FIREFIGHTING EQUIPMENT COMPONENTS													
	Fire Extinguisher:													
	Extinguishers, fire	C	--	--	--	--	--	--	C					
	PART II CARRIER (F817G)													
01	ENGINE													
0100	Engine Assembly:													
	Engine	C	O	--	--	--	--	--	H	O	H	--	--	A–B
0101	Crankcase, Cyl. Head:													
	Crankcase	O	--	O	--	--	--	--	H	H				
	Head cylinder	--	--	--	--	--	--	--	F	F				
0102	Crankshaft:													
	Crankshaft assembly	H	--	--	--	--	--	--	H	D	--	--	--	B–I
0103	Flywheel Assembly:													
	Flywheel	--	--	--	--	--	--	--	F	F	--	--	--	C–I
0104	Pistons, Connecting Rods:													
	Pistons	H	--	--	--	--	--	--	H					
	Rods, connecting	H	--	--	H	--	--	--	H					
0105	Valves Camshaft & Timing System:													
	Valves and inserts	--	--	--	--	--	--	--	F	F				
	Arms, rocker	--	--	--	O	--	--	--	F	F				
	Tappets	F	--	--	--	--	--	--	F					
	Camshaft, bearings & gear	F												
	Timing	H	--	--	--	--	--	--	H					
	Cover	O	--	--	--	--	--	--	H					
0106	Engine Lubrication System:													
	Pump, oil	--	--	--	--	--	--	--	F	F				
	Pan, oil	O	--	O	--	--	--	--	F					
	Filter, oil	--	--	O	--	--	--	--	O					
	Lines, external	--	--	--	--	--	--	--	O	O				
0108	Manifold:													
	Manifold assembly	O	--	--	--	--	--	--	O	O				
0109	Accessory Drive Mechanism:													
	Shaft	--	--	--	--	--	--	--	O	F				
	Housing	--	--	--	--	--	--	--	O	F				
02	CLUTCH													
0200	Clutch Assembly:													
	Clutch assembly	O	--	--	O	--	--	--	F	F				

Section II. MAINTENANCE ALLOCATION CHART--Cont'd

(1)	(2)	(3) Maintenance functions											(4)	(5)
		A	B	C	D	E	F	G	H	I	J	K		
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks
0202	Clutch Release													
	Mechanism:													
	Clutch pedal linkage	--	--	--	O	--	--	--	F					
	Shaft bearing; yoke	--	--	--	F	--	--	--	F					
03	FUEL SYSTEM													
0301	Carburetor:													
	Carburetor	--	--	--	O	--	--	--	O	F				
0302	Fuel Pump:													
	Pump fuel	C	--	--	--	--	--	--	O					
0304	Air Cleaner:													
	Air cleaner assembly	--	--	C	--	--	--	--	O					
0306	Tank, Lines, Fittings:													
	Tank	--	--	C	--	--	--	--	O	H				
	Lines, fittings	--	--	--	--	--	--	--	O	O				
0308	Engine Speed Governor and Controls:													
	Governor assembly	--	--	--	O	--	--	--	O	F				
0309	Fuel Filters:													
	Filter fuel	--	--	C	--	--	--	--	O					
0311	Engine Starting Aids:													
	Pump and fittings	C	--	--	--	--	--	--	O					
	Lines	--	--	--	--	--	--	--	O	O				
0312	Accelerator, Throttle or Choke Controls:													
	Controls	--	--	--	--	--	--	--	O	O				
04	EXAUST SYSTEM:													
0401	Muffler and pipes	C	--	--	--	--	--	--	O					
05	COOLING SYSTEM:													
0501	Radiator:													
	Radiator	--	--	C	--	--	--	--	O	H				
	Cap radiator	--	O	--	--	--	--	--	O					
0502	Cowling:													
	Cowling	--	--	--	--	--	--	--	O	H				

0503	**Water Manifold & Thermostat:**													
	Manifold	O	--	--	--	--	--	--	O					
	Thermostat & housing gasket	--	O	--	--	--	--	--	O					
0504	**Water Pump:**													
	Pump water	--	--	--	--	--	--	--	O	F				
0505	**Fan Assembly:**													
	Bearing shaft, pulley	--	--	O	--	--	--	--	O					
	Fan	C	--	--	--	--	--	--	O					
	Belt	--	--	--	O	--	--	--	O					
06	**ELECTRICAL SYSTEM**													
0601	**Generator:**													
	Generator	--	O	--	--	--	--	--	O	F	--	--	--	E-H
0603	**Starting Motor:**													
	Starting motor	--	O	--	--	--	--	--	O	F	--	--	--	F-H
	Solenoid	--	O	--	--	--	--	--	O					
	Brushes	F	--	--	--	--	--	--	F					
0605	**Ignition Components**	--	--	--	--	--	--	--	--	--	--	--	--	G-H
	Distributor assembly	--	--	--	O	--	--	--	O					
	Coil	--	O	--	--	--	--	--	O					
	Spark plugs	--	O	--	O	--	--	--	O					
	Wiring supression	--	O	--	--	--	--	--	O	F				
0607	**Instrument or Engine Control Panel:**													
	Wiring harness	--	--	--	--	--	--	--	F	O				
	Panel	--	--	--	--	--	--	--	O					
	Switches, gages, lamps	--	--	--	--	--	--	--	O					
0608	Miscellaneous Items:													
	Switches, receptacle	C		--	--	--	--	--	O					
	Cables, slave	--		--	--	--	--	--	O	O				
	Wiring					--	--	--	O	O				
0609	Lights:													
	Lights	C							O	O				
0610	Sending Unit:													
	Sending units, oil & water		O						O					
0611	Horn:													
	Horn, button, wiring	C							O					
0612	Batteries:													
	Battery		O	C					O					
	Cables	C							O	O				
0613	Chassis Wiring Harness:													
	Harness								F	O				
	Coupling trailer	C							O					

Section II. MAINTENANCE ALLOCATION CHART—Cont'd

(1)	(2)	(3) Maintenance functions											(4)	(5)
		A	B	C	D	E	F	G	H	I	J	K		
Group No.	Functional group	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and equipment	Remarks
0615	Radio Supression: Components	--	O	--	--	--	--	--	O	O				
07	TRANSMISSION													
0700	Transmission Assembly: Transmission	C	--	C	--	--	--	--	F	F	H			
0701	Transmission Shaft: Gears, Bearing, Seal	F	--	--	--	--	--	--	H					
0703	Transmission, and Clutch Controls	O	--	--	--	--	--	--	F					
0704	Transmission Top Cover Assy.: Cover Assembly	--	--	--	--	--	--	--	F	F				
08	TRANSFER ASSEMBLY													
0800	Gear Shifts, Controls: Controls	--	--	C	--	--	--	--	O	O				
0801	Power Transfer Assembly: Transfer assembly	C	--	C	--	--	--	--	F	H				
09	PROPELLER & PROPELLER SHAFTS													
0900	Propeller Shafts	--	--	C	--	--	--	--	O	F				
10	FRONT AXLE													
1000	Front Axle Assembly: Axle assembly	C	--	--	--	--	--	--	F	F	H			
1002	Differential: Differential assembly	C	--	O	--	--	--	--	F	F				
11	REAR AXLE													
1100	Rear Axle Assembly: Axle assembly	C	--	--	--	--	--	--	F	H	H			
1102	Differential Differential assembly	C	--	O	--	--	--	--	H	H				

12	**BRAKES**												
1202	**Service Brakes:**												
	Brakes, service	--	--	O	O	--	--	--	F	F			
	Shoes	--	--	--	--	--	--	--	O	F			
1208	**Air Brake System:**												
	Chamber, brake	--	--	--	--	--	--	--	O	F			
	Evaporator	--	--	--	--	--	--	--	O	O			
	Reservoir	C	--	--	--	--	--	--	O				
	Valves	C	--	--	--	--	--	--	O				
	Hoses, fitting	C	--	--	--	--	--	--	O	O			
1209	**Air Compressor Assembly:**												
	Compressor Assembly	C	--	C	O	--	--	--	O	F			
1211	**Trailer Brake Connection:**												
	Valves, coupling, lines	--	--	--	--	--	--	--	O	F			
13	**WHEELS**												
1301	**Wheel & Track Suspension Assy.:**												
	Torque rod	--	--	--	--	--	--	--	H	H			
1311	**Wheel Assembly:**												
	Wheel Assembly	C	--	--	--	--	--	--	O				
1313	**Tires and Tubes:**												
	Tires	C	--	C	--	--	--	--	O				
	Tubes	--	--	--	--	--	--	--	O	O			
14	**Steering**												
1401	**Steering Assembly:**												
	Tie rods, draglink	--	--	C	--	--	--	--	O				
	Wheel	C	--	--	--	--	--	--	O				
1407	**Power Steering Gear Assy.**	--	--	--	--	--	--	--	F	F			
1410	**Hydraulic Pump:**												
	Pump hydraulic	--	--	--	--	--	--	--	O	F			
	Belt	--	--	--	O	--	--	--	O				
1411	**Hoses, Lines, Fittings:**												
	Hoses, lines, fitting	C	--	--	--	--	--	--	O				
1413	**Reservoir:**												
	Reservoir	--	--	C	--	--	--	--	O				
15	**FRAME ASSEMBLY**												
1501	**Frame Assembly**	--	--	--	--	--	--	--	H				
	Boom rest	C	--	--	--	--	--	--	O	F			
1503	**Pintless:**												
	Pintless	--	--	C	--	--	--	--	O	O			
1507	**Levling Jacks:**												
	Outriggers	--	--	C	--	--	--	--	O	O			

Section II. MAINTENANCE ALLOCATION CHART—Cont'd

(1)	(2)	(3) Maintenance functions											(4)	(5)
Group No.	Functional group	A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	Tools and equipment	Remarks
16	SPRING, SHOCK ABSORBERS													
1601	Springs:													
	Springs front	--	--	--	--	--	--	--	F	F				
1604	Shock Absorber Equipment:													
	Absorbers, shock	C	--	--	--	--	--	--	O					
1605	Torque, rods:													
	Rods torque	--	--	--	--	--	--	--	F	F				
18	BODY, CAB, HOOD ASSEMBLY													
1801	Body, Cab, Hood, Assembly:													
	Cab	--	--	--	--	--	--	F	O					
	Fenders	--	--	--	--	--	--	O	F					
1806	Upholstery, Seat, Carpet:													
	Seat	--	--	--	--	--	--	O	F					
22	BODY CHASSIS OR HULL & ACCESSORY ITEMS													
2202	Accessory Items:													
	Wiper motor, blade	--	--	--	--	--	--	O	F					
2210	Data plates:													
	Plates, data	C	--	--	--	--	--	O						
47	CAGES													
4701	Instruments, Speedometer Drive	--	--	C	--	--	--	O						
50	PNEUMATIC EQUIPMENT:													
5000	Crankcase, Block, Cyl. Head	--	--	--	--	--	--	--	H	--	--	D		
	Crankcase, cyl. block													
	Head cylinder	--	--	--	--	--	--	--	F	D				

	Crankshaft Crankshaft	--	--	--	--	--	--	--	D	D				
	Pistons, Connecting rods: Piston, rods connecting	F	--	--	--	--	--	--	F					
	Valves & Timing Mechanism: Valves, springs	F	--	--	--	--	--	--	F					
	Lubrication System: Case	O	--	--	--	--	--	--	O					
	Compressor Drive: Pulley	O	--	--	--	--	--	--	O					
	Belt	--	--	--	O	--	--	--	O					
	Air Tanks: Strainer	--	--	C	--	--	--	--	O					
76	FIRE FIGHTING EQUIPMENT							--	O					
7603	Fire Extinguisher: Extinguisher, fire	--	--	C	--	--	--	--	O					

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference Code	Maintenance level	Nomenclature	Tool number
		None Applicable	

Section IV. REMARKS

Reference code	Remarks
	CARRIER PORTION
A-B	Compression
B-I	Metalize and Resize
C-I	Install Ring Gear
D-H	Includes Repair Kit
E-H	Includes Repair Kit
F-H	Includes Repair Kit
G-H	Includes Points, Cap, Capacitor
	CRANE PORTION
A-B	Compression
B-I	Metalize and Resize
C-I	Install Ring Gear
D-H	Includes Repair Kit
E-H	Includes Repair Kit
F-H	Includes Repair Kit
G-H	Includes Points, Cap, Capacitor

PART ONE

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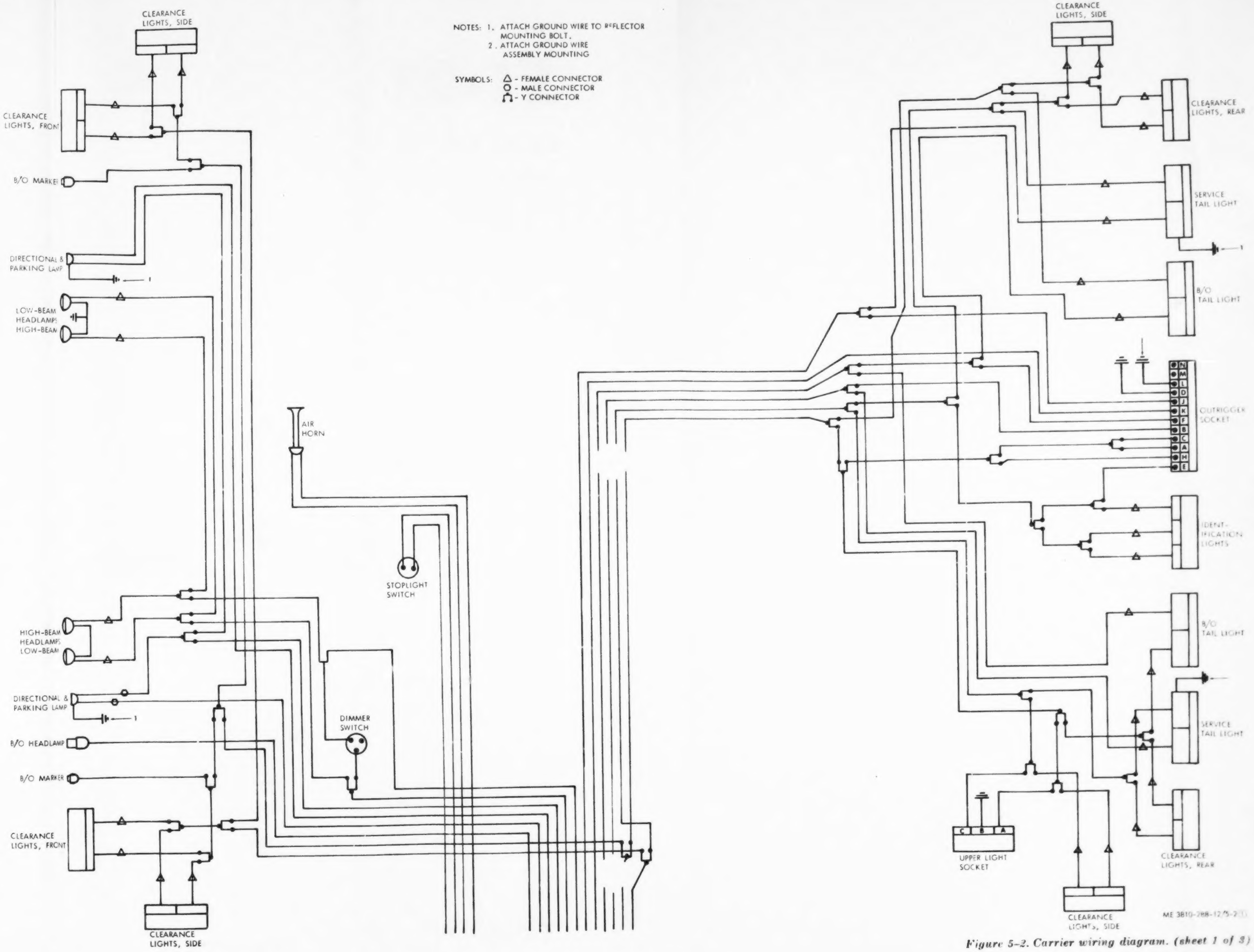
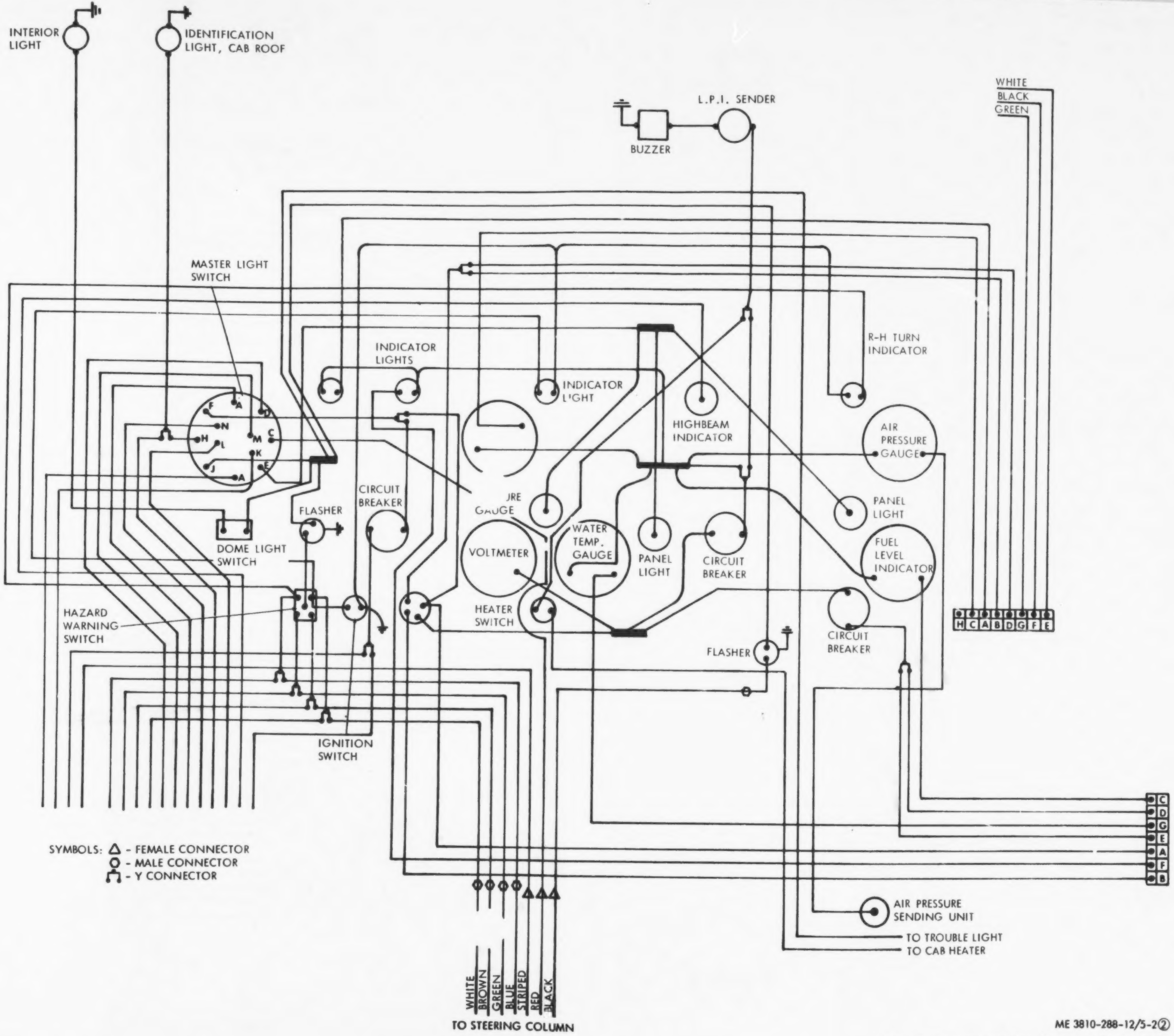

CLEARANCE LIGHTS, SIDE
CLEARANCE LIGHTS, FRONT
B/O MARKER
DIRECTIONAL & PARKING LAMP
LOW-BEAM
HEADLAMPS
HIGH-BEAM
AIR HORN
STOPLIGHT SWITCH
HIGH-BEAM
HEADLAMPS
LOW-BEAM
DIRECTIONAL & PARKING LAMP
DIMMER SWITCH
B/O HEADLAMP
B/O MARKER
CLEARANCE LIGHTS, FRONT
CLEARANCE LIGHTS, SIDE
CLEARANCE LIGHTS, SIDE
CLEARANCE LIGHTS, REAR
SERVICE TAIL LIGHT
B/O TAIL LIGHT
N
M
L
D
J
K
F
B
C
A
H
E
OUTRIGGER SOCKET
IDENTIFICATION LIGHTS
B/O TAIL LIGHT
SERVICE TAIL LIGHT
C
B
A
UPPER LIGHT SOCKET
CLEARANCE LIGHTS, REAR
CLEARANCE LIGHTS, SIDE
ME 3810-288-12/5-2(1)

NOTES: 1. ATTACH GROUND WIRE TO REFLECTOR MOUNTING BOLT.
2. ATTACH GROUND WIRE ASSEMBLY MOUNTING

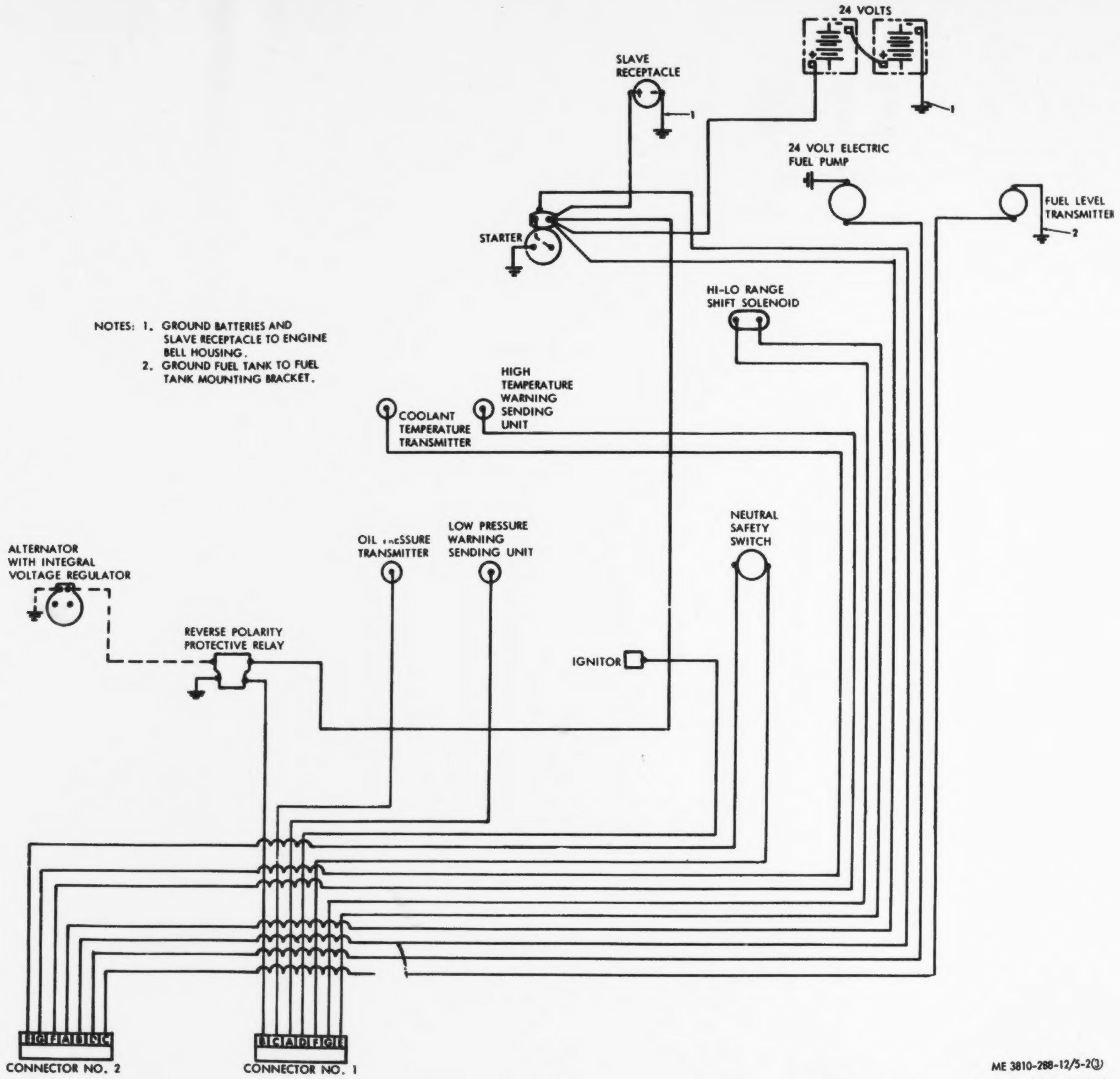
SYMBOLS: △ - FEMALE CONNECTOR
○ - MALE CONNECTOR
⋂ - Y CONNECTOR

Figure 5-2. Carrier wiring diagram. (sheet 1 of 3)


INTERIOR LIGHT
IDENTIFICATION LIGHT, CAB ROOF
L.P.I. SENDER
BUZZER
WHITE
BLACK
GREEN
MASTER LIGHT SWITCH
F
A
D
N
C
M
H
L
K
J
E
A
INDICATOR LIGHTS
INDICATOR LIGHT
R-H TURN INDICATOR
HIGHBEAM INDICATOR
AIR PRESSURE GAUGE
PANEL LIGHT
FUEL LEVEL INDICATOR
CIRCUIT BREAKER
FLASHER
DOME LIGHT SWITCH
JRE GAUGE
VOLTMETER
WATER TEMP. GAUGE
PANEL LIGHT
CIRCUIT BREAKER
HEATER SWITCH
FLASHER
CIRCUIT BREAKER
H
C
A
B
D
G
F
E
HAZARD WARNING SWITCH
IGNITION SWITCH
C
D
G
E
A
F
B
SYMBOLS: △ - FEMALE CONNECTOR
○ - MALE CONNECTOR
- Y CONNECTOR
AIR PRESSURE SENDING UNIT
TO TROUBLE LIGHT
TO CAB HEATER
WHITE
BROWN
GREEN
BLUE
STRIPED
RED
BLACK
TO STEERING COLUMN

ME 3810-288-12/5-2②

Figure 5-2. Carrier wiring diagram. (sheet 2 of 2)



24 VOLTS
1
SLAVE RECEPTACLE
1
24 VOLT ELECTRIC FUEL PUMP
FUEL LEVEL TRANSMITTER
2
STARTER
HI-LO RANGE SHIFT SOLENOID
HIGH TEMPERATURE WARNING SENDING UNIT
COOLANT TEMPERATURE TRANSMITTER
NEUTRAL SAFETY SWITCH
OIL PRESSURE TRANSMITTER
LOW PRESSURE WARNING SENDING UNIT
ALTERNATOR WITH INTEGRAL VOLTAGE REGULATOR
REVERSE POLARITY PROTECTIVE RELAY
IGNITOR
B G F A D N C
CONNECTOR NO. 2
B C A D F G E
CONNECTOR NO. 1

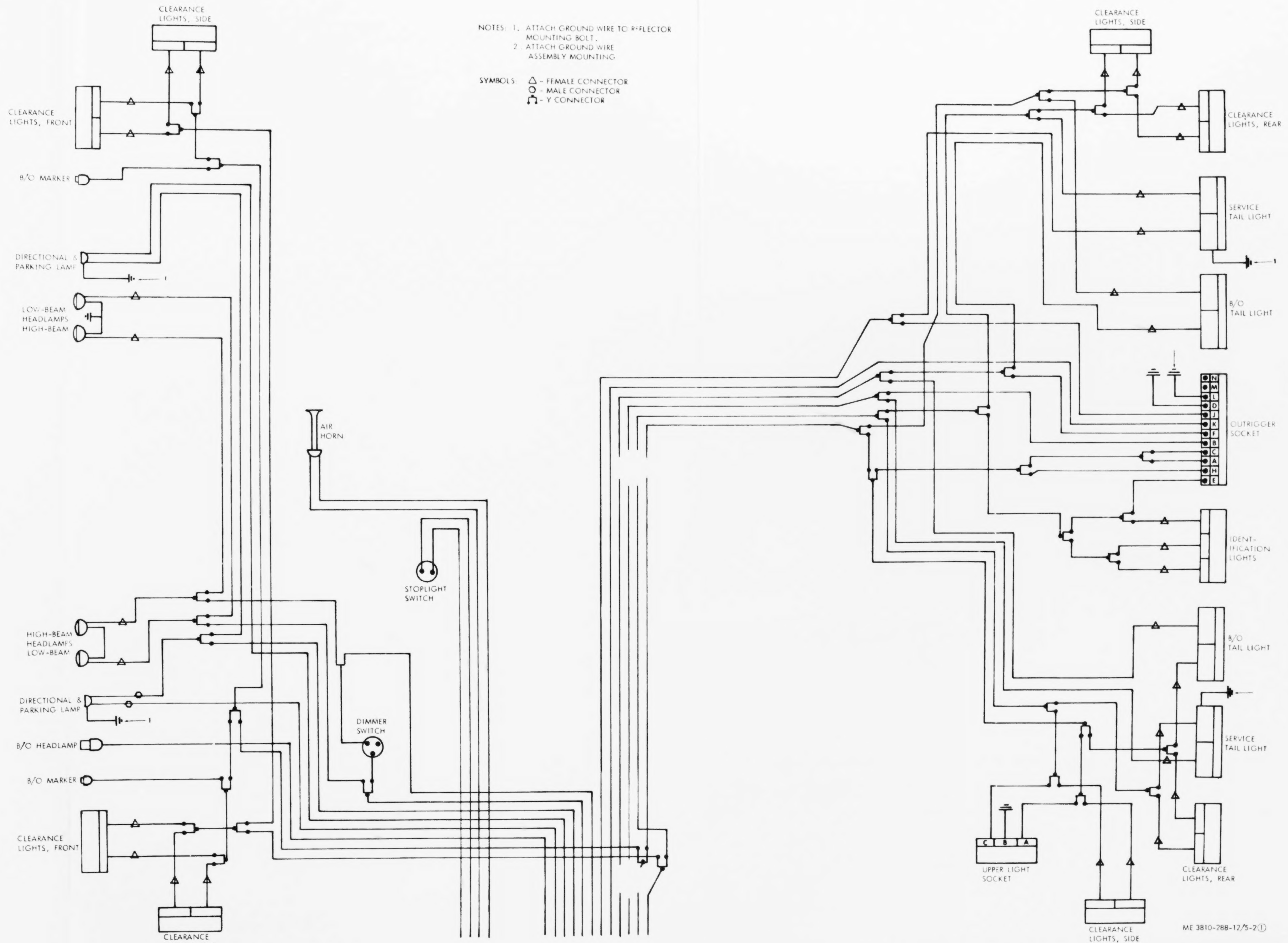
NOTES: 1. GROUND BATTERIES AND SLAVE RECEPTACLE TO ENGINE BELL HOUSING.
2. GROUND FUEL TANK TO FUEL TANK MOUNTING BRACKET.

ME 3810-288-12/5-2③

Figure 5-2. Carrier wiring diagram. (sheet 3 of 3)

Charts Transposed to

End of Volume.



CLEARANCE LIGHTS, SIDE
CLEARANCE LIGHTS, FRONT
B/O MARKER
DIRECTIONAL & PARKING LAMP
1
LOW-BEAM
HEADLAMPS
HIGH-BEAM
AIR HORN
STOPLIGHT SWITCH
HIGH-BEAM
HEADLAMPS
LOW-BEAM
DIRECTIONAL & PARKING LAMP
1
DIMMER SWITCH
B/O HEADLAMP
B/O MARKER
CLEARANCE LIGHTS, FRONT
CLEARANCE LIGHTS, SIDE
CLEARANCE LIGHTS, SIDE
CLEARANCE LIGHTS, REAR
SERVICE TAIL LIGHT
1
B/O TAIL LIGHT
N
M
L
D
J
K
F
B
C
A
H
E
OUTRIGGER SOCKET
IDENT-IFICATION LIGHTS
B/O TAIL LIGHT
SERVICE TAIL LIGHT
C
B
A
UPPER LIGHT SOCKET
CLEARANCE LIGHTS, REAR
CLEARANCE LIGHTS, SIDE

NOTES: 1. ATTACH GROUND WIRE TO REFLECTOR MOUNTING BOLT.
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SYMBOLS: △ - FEMALE CONNECTOR
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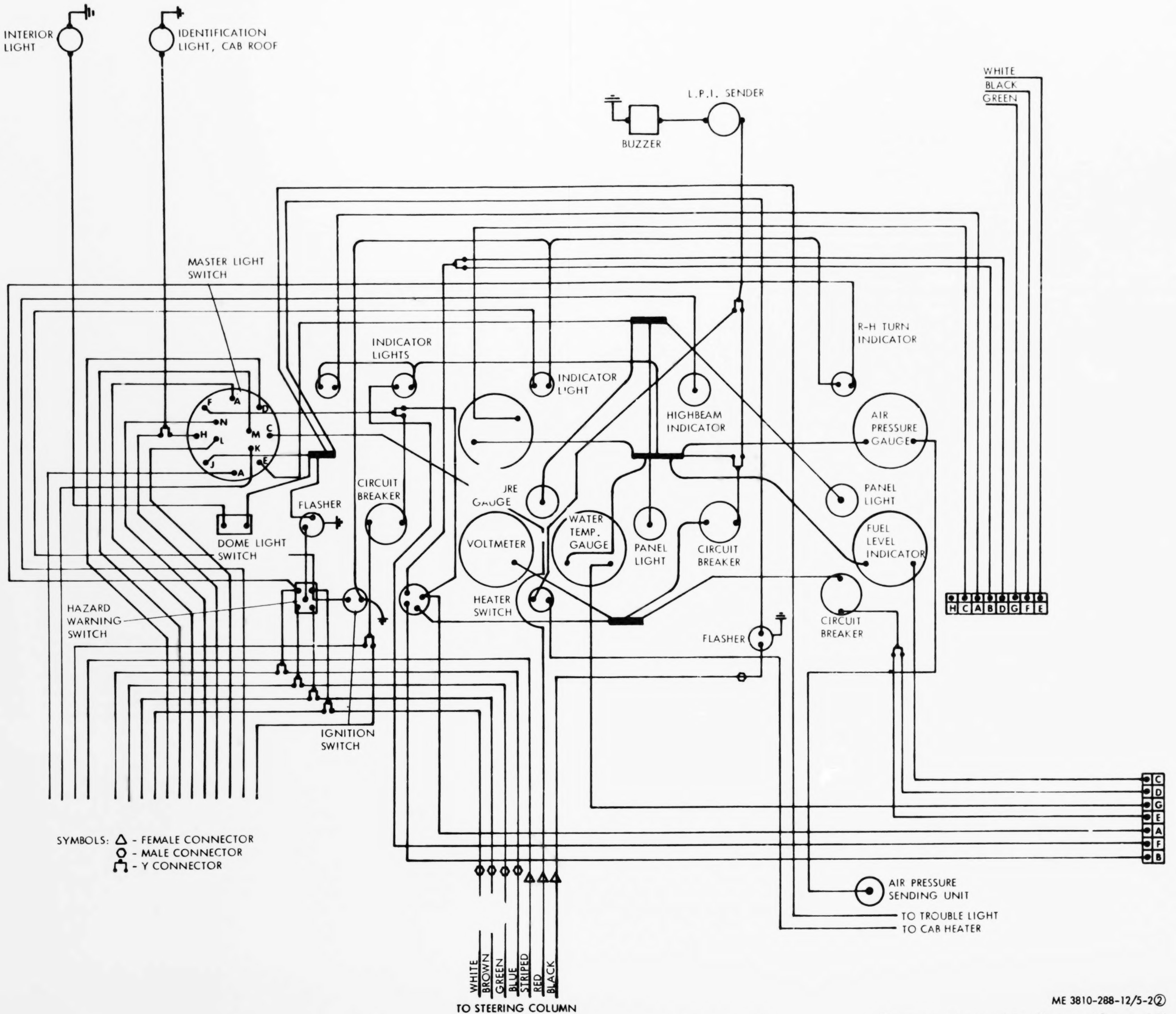
ME 3810-288-12/5-2①

Figure 5-2. Carrier wiring diagram. (sheet 1 of 3)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INDICATOR L'GHT
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JRE GAUGE
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FLASHER
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VOLTMETER
WATER TEMP. GAUGE
PANEL LIGHT
CIRCUIT BREAKER
FUEL LEVEL INDICATOR
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HAZARD WARNING SWITCH
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C D G E A F B
SYMBOLS: △ - FEMALE CONNECTOR
○ - MALE CONNECTOR
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TO TROUBLE LIGHT
TO CAB HEATER
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GREEN
BLUE STRIPED
RED
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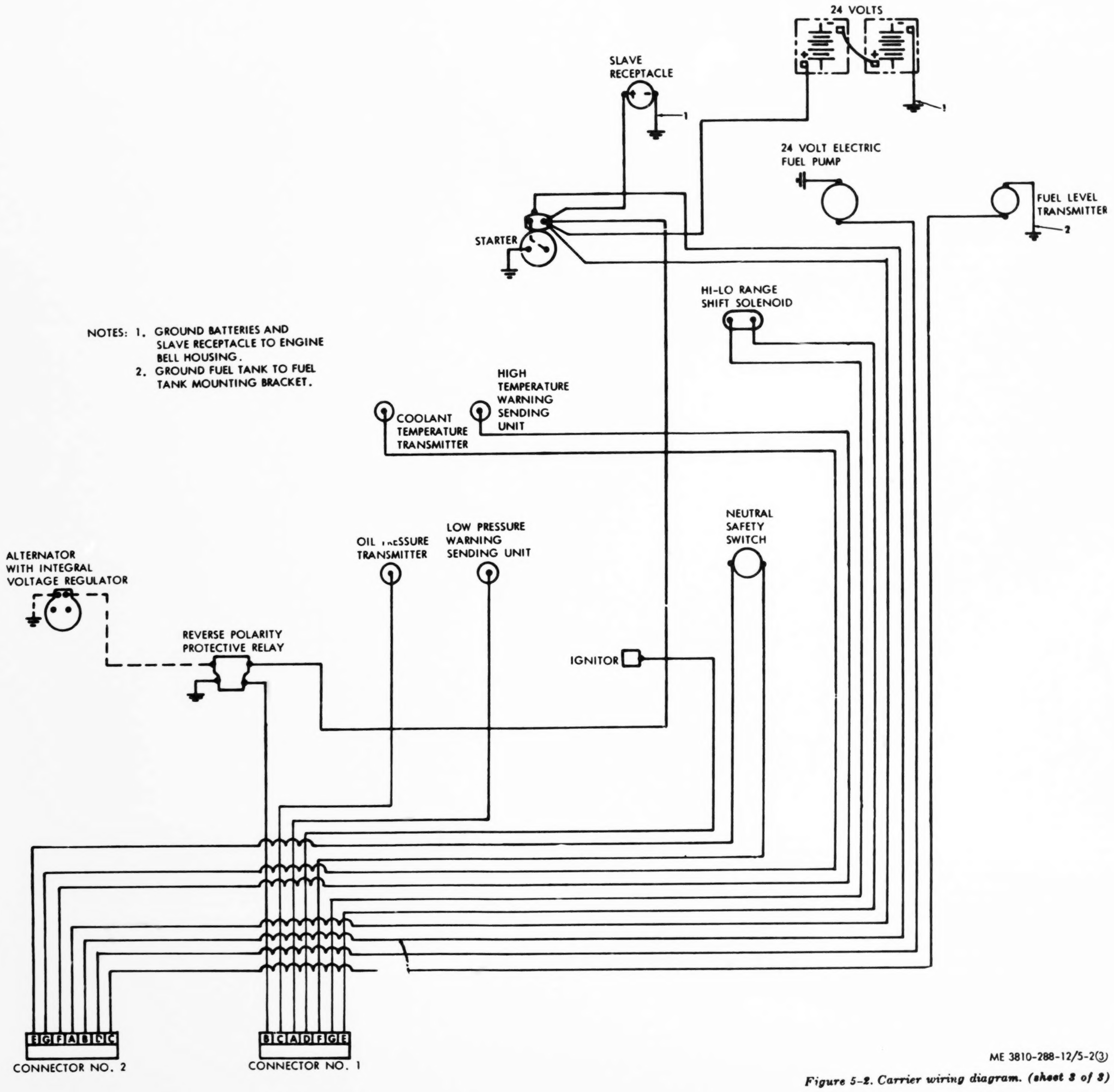
TO STEERING COLUMN
ME 3810-288-12/5-2②

Figure 5-2. Carrier wiring diagram. (sheet 2 of 3)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24 VOLT ELECTRIC FUEL PUMP
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NEUTRAL SAFETY SWITCH
OIL PRESSURE TRANSMITTER
LOW PRESSURE WARNING SENDING UNIT
ALTERNATOR WITH INTEGRAL VOLTAGE REGULATOR
REVERSE POLARITY PROTECTIVE RELAY
IGNITOR
E G F A B D C
CONNECTOR NO. 2
B C A D F G E
CONNECTOR NO. 1

NOTES: 1. GROUND BATTERIES AND SLAVE RECEPTACLE TO ENGINE BELL HOUSING.
2. GROUND FUEL TANK TO FUEL TANK MOUNTING BRACKET.

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Figure 5-2. Carrier wiring diagram. (sheet 3 of 3)

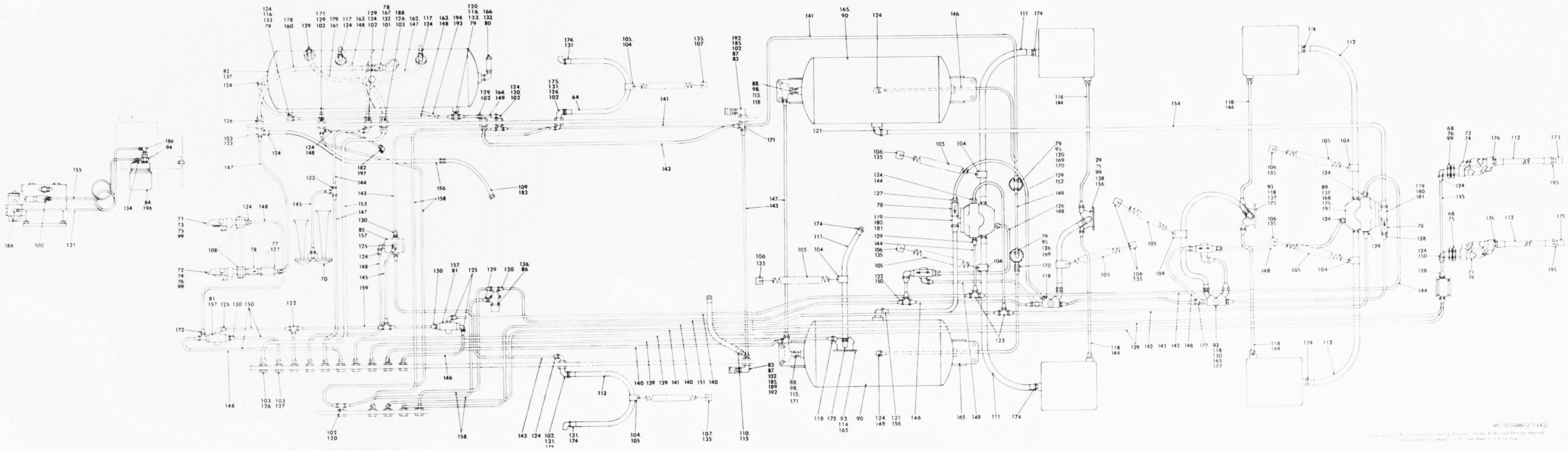
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Figure [illegible] brake system piping diagram, valves, hoses and fittings, removal and replacement (Sheet 2 of 2). See sheet 1 of 2 for key.